EFFECTIVENESS OF ENDO TRACHEAL SUCTIONING WITH NORMAL SALINE VERSUS WITHOUT NORMAL SALINE ON AIRWAY CLEARANCE AMONG INTUBATED PATIENTS AT GOVERNMENT RAJAJI HOSPITAL, MADURAI.

M.Sc (NURSING) DEGREE EXAMINATION

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A dissertation submitted to

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CHENNAI - 600032.

In partial fulfillment of the requirement for the degree of

MASTER OF SCIENCE IN NURSING

OCTOBER 2017

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CERTIFICATE

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ABSTRACT

Title : Effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji hospital, Madurai. Aim: To evaluate the Effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji hospital, Madurai. **Objectives** To assess the level of airway clearance among the intubated patients on mechanical ventilator in both group 1 and group11 and to associate the level of airway clearance among GroupI and Group II intubated patients with their selected socio demographic and clinical variable. **Hypotheses** There is a significant difference between Group I and Group II after endotracheal suctioning on airway clearance among intubated patients. There is a significant difference between the pretest and post test scores of airway clearance in both group1 and in group II after endotracheal suctioning.There is a significant association between the level of airway clearance among intubated patients with their selected socio demographic data and clinical variables..**Methodology:** A True experimental design was used. 60 subjects were selected by consecutive sampling method. Intervention Endotracheal suctioning without normal saline was given to the group1 and endotracheal suctioning with normal saline was given to the group 11 every second hourly and also on demand basis from 7am to 7pm. Pretest before endotracheal suctioning and post test 10 minutes after the last suctioning at 7pm were done with structured observational check list .**Findings:** There was a significant reduction score 5.9% in group I patients and 29.2% of reduction score in group II.There was significant association between pretest level of airway clearance score and Younger, females and with less duration of admission in hospital were having more reduced air clearance score than others.

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Introduction

CHAPTER 1

INTRODUCTION

“Breathing is the key that unlocks the whole catalog of advanced biological function and development. Is it any wonder that is so central to every aspect of health? Breathing is the first place not the last, one should look when fatigue, disease, or other evidence of disordered energy present itself. Breathing is truly the body s most communication.”

Sheldon Saul Hender, MD., PhD.,

The Respiratory System is vital to every human being. It is a physiological function that is almost synonymous with being alive and without it, we would cease to live outside of the womb. The organs of the respiratory system make sure that oxygen enters in to the lungs and carbon dioxide leaves from the lungs. The respiratory tract is the pathway of air from the nose to the lungs. Ventilation is the exchange of air between the external environment and the alveoli. Air moves by bulk flow from an area of high pressure to low pressure. The rhythm of ventilation is also controlled by the "Respiratory Center" which is located largely in the medulla oblongata of the brain stem.

According to Abraham Maslow’s Hierarchy of needs the physiological needs are at the first level of the needs. Unless one fulfill their physiological needs one can’t address to higher needs. The basic needs are air, food, water and shelter. In this oxygen is very important to all living organism. To receive oxygen from the atmosphere respiration is very important and that is the act of breathing. The normal adult respiration is 16-20 per minute.

If a person is having any abnormality in the respiratory system he or she can have abnormal respiration that is tachypnoea or bradypnoea. Respiratory failure can occurs when there is an improper gas exchange between the lungs, blood and tissues. Body's vital organs, such as heart and brain, need oxygen-rich blood to work well. Respiratory failure can happen if lungs can't remove carbon dioxide (a waste gas) from our blood. Too much carbon dioxide in blood can harm body's vital organs. Respiratory failure is a common disease, and, in potentially reversible cases, ventilatory support is necessary for life-saving. A patient with acute respiratory failure generally should be admitted in emergency critical care units for further life saving support.

The critically ill patient is a complex person in a complex environment. The nursing care of critically ill patients are challenging to the patient and also to the team of health care providers. Nurses, who monitors the patients continuously, needs to have sound knowledge, skills and careful judgment and decision making. She has to follow systemic approach in assessing, goal setting, planning, implementing and evaluating the nursing care provided to the patients. Nurses requires to have broad knowledge of sciences, pathophysiology and inter personal relations to make the clinical practice more effective in the critical care unit. It is necessary to have policies, procedures, protocols for care based on the hospital setup and quality assurance programs in corporate also.

Critical care nursing refers to comprehensive, specialized and individualized nursing care services which are rendered to patients with life threatening conditions and their families. The serious nature of illness of these patients who considered being critically ill, demand expert and sophisticated nursing. Nurses looking after these patients to be skilled and autonomous in specific aspects of the therapeutic

management of these patients. In addition, they have to work in partnership with all the health care worker of the intensive care unit with shared responsibilities. Above all they have to remember constantly that these patients are totally dependent on the nurses and doctors of the intensive care unit.

Intensive care unit is a distinct unit within the hospital that has easy access to the emergency department, operating theatre, and medical imaging. It provides care to patients with a life threatening illness or injury and clinical expertise, technological and therapeutic resources required to treat Intensive care clients. Critical care unit is staffed by skilled personnel to provide quality and effective safe care for dependent patients with life threatening problems. The concept of Intensive Care nursing took its root from Florence Nightingale, the Founder of Modern Nursing. Intensive care is usually only offered to those whose condition is potentially reversible and who have a good chance of surviving with intensive care support. A prime requisite for admission to an intensive care unit (ICU) is that the underlying condition can be overcome such as hypertension or hypotension, airway or respiratory compromise such as ventilator support, Acute renal failure, Potentially lethal cardiac arrhythmias, Multiple organ failure, Multiple organ dysfunction syndrome ,for intensive/invasive monitoring.

Intensive care usually takes a system by system approach to treatment, rather than the SOAP (subjective, objective, analysis, plan) approach of high dependency care. The nine key systems (alphabetically): Cardiovascular system, Central nervous system, Endocrine system, Gastro-intestinal tract (and nutritional condition),Hematology, Microbiology (including sepsis status),Peripheries (and skin),Renal (and metabolic),Respiratory system are each considered on an observation-Group-impression basis to produce a daily plan. As well as the key

systems, intensive care treatment raises other issues including psychological health, pressure points, mobilization and physiotherapy, and secondary infections.

Common procedures/Groups done in intensive care unit include mechanical ventilation – using a machine known as a ventilator to assist breathing, invasive monitoring, including central venous cannulation where a tube known as a cannula is inserted into a blood vessel, usually for the delivery or removal of fluids, endotracheal intubation – a flexible tube is inserted through the nose or mouth into the trachea for artificial ventilation, percutaneous dilatational tracheostomy – a minimally invasive procedure where the trachea (wind-pipe) is opened from the front of the neck to enable air to be passed into the lower air passages weaning from mechanical ventilation – enabling the withdrawal of ventilator support ,insertion of intercostal chest drains – a thin flexible tube (catheter) is inserted through the chest wall into the pleural space (around the lungs) to help drain air, blood or fluids, massive transfusions – replacement of large amounts of blood, organ support with inotropes (drugs that stimulate the heart) and vasopressors (drugs that raise reduced blood pressure), measurement of cardiac (heart) output.

The maintenance of normal breathing rate and pattern is very important. When there is breathing that means the person is alive. When the patient is struggling for breathing that means that the patient is struggling to survive. In that condition the health team members have to intubate the patient to take care of the respiration and that is the second important step in cardio pulmonary resuscitation. Artificial respiration is achieved by Endo Tracheal intubation, which is usually simply referred to as intubation. Intubation is the placement of a flexible plastic tube into the trachea (windpipe) to maintain an open airway serve as a conduit.

The ventilator, or respirator, is a breathing machine that helps patients breath when they are too ill to breathe on their own. A patient is connected to the ventilator by an endotracheal tube (a flexible plastic tube that is inserted into the mouth and then down into the trachea). It is often necessary for a patient to be sedated while on the ventilator, which may limit his or her ability to respond. This is necessary both for patient comfort and for the ventilator to be able to work effectively. As a patient's lungs recover, the amount of ventilator support is gradually decreased until it is felt a patient can breathe on his or her own. Assurance of an adequate airway is vital in a patient with acute respiratory distress. The most common indication for endotracheal intubation is respiratory failure. Endotracheal intubation serves as an interface between the patient and the ventilator. Another indication is airway protection in patients with altered mental status. Mechanical ventilation is used for 2 essential reasons: (1) to increase PaO_2 and (2) to lower $PaCO_2$. Mechanical ventilation also rests the respiratory muscles and is an appropriate therapy for respiratory muscle fatigue.

Endotracheal intubation (TI) is commonly performed in respiratory failure and shock, and is one of the most commonly performed procedures in the intensive care unit (ICU). It is an essential life-saving Group; Endotracheal intubation and the institution of invasive mechanical ventilation are resources which are widely used in the management of critically-ill patients, so as to provide sufficient gaseous exchange for those with some sort of respiratory insufficiency. However, these devices can cause detrimental effects - inflammation, infections, and traumatic lesions to the airways -, which require preventive care. The appropriate management of the artificial airway has a direct impact on the patients' prognosis, including reduction of morbidity, mortality, length of hospitalization, and hospital cost.

Intubated patients are usually critically ill and are either conscious or unconscious. They are unable to clear secretions effectively, as glottic closure is compromised and normal mucociliary function is impaired. Inadequately humidified inspired gas and the presence of the endotracheal tube (ETT) may cause irritation to the airways and produce more secretion. In addition, many people with respiratory tract infections have increased sputum volume and altered sputum, which further impedes secretion clearance. Therefore, all patient with an artificial airway require endotracheal (ET) suctioning to remove secretions and prevent airway obstruction. Air sac collapse occurs if secretions are not drained in intubated patients unable to cough.

Endotracheal suctioning (ETS) is one of the most common procedure performed in patients with artificial airways. It is a component of bronchial hygiene therapy and mechanical ventilation that involves the mechanical aspiration of pulmonary secretions from a patient’s artificial airway to prevent its obstruction and to maintain a patent airway. It facilitates the drainage of secretions and keeps the airways clear. Various methods are used to drain secretions in the suctions. Suction may be applied open or closed, deep or shallow, with or without normal saline. It is directed at removing secretions and, through this, promoting the maintenance of the airways' permeability, as well as optimizing ventilation and oxygenation and it is essential for the stability of pulmonary function, as the presence of a ventilatory prosthesis interferes in the physiology of coughing and of the mucociliary system, which can inviabilize the adequate clearance of secretions from the trachea bronchial tree and cause stasis of this content. This can leads to the complication such as air sac collapse, atelectasis, infections, respiratory compromise, obstruction of the endotracheal tube, hemodynamic changes and death.

Suction procedure should therefore be as brief as possible, lasting approximately 10 to15 seconds. The suction catheter diameter should be half the diameter less of the tracheal tube. This prevents the occlusion of the airway and avoid the generation of large negative intra thoracic pressures .The negative pressure set on the suction machine needs to be sufficiently high to clear secretion while avoiding trauma to the bronchial mucosa. (Ashurst 1997) recommended a setting of 120mmHg. In practice, it is some time necessary to apply higher levels of negative pressure to clear thick, tenacious secretions; it should be done cautiously.

Globally, respiratory tract infections contribute significantly to morbidity and mortality in the patient with artificial ventilation. The most common critical complaints in Intensive Care Units (ICUs) are concerned with the airways, since respiratory system dysfunction and the inability to breathe spontaneously comprise the main challenges in ICUs. Mechanical ventilators and endotracheal tubes thus constitute integral parts of ICUs. Endotracheal tube suction is therefore commonly performed in ICUs for clearing the airways.

1.1 Need for the Study

Respiratory failure has many causes and can come on abruptly acute respiratory failure, when the underlying cause progresses rapidly or slowly chronic respiratory failure when it is associated over months or even years with a progressive underlying process. Typically, respiratory failure initially affects the ability either to take up oxygen referred to as oxygenation failure or to eliminate carbon dioxide s(referred to as ventilatory failure). Eventually, both functions cease when the respiratory failure becomes severe enough.

Because so many underlying causes contribute to it, respiratory failure is a common and major cause of illness and death. It is the main cause of death from

pneumonia and chronic obstructive pulmonary disease (COPD), which together comprise the third-leading cause of death in the United States today. It is also the main cause of death in many neuromuscular diseases, such as Lou Gehrig disease(amyotrophic lateral sclerosis or ALS), because these diseases weaken the respiratory muscles, rendering them incapable of sustaining breathing.

Epidemiologic studies suggest that respiratory failure will become more common as the population ages, increasing by as much as 80 percent in the next 20 years .Because respiratory failure is such a common cause of illness and death, the cost to society in terms of lost productivity and shortened lives is enormous. However, it is hard to quantify because the cause of death is more likely to be listed as pneumonia, choric obstructive pulmonary disease or another underlying condition, rather than respiratory failure. In patients with neuromuscular disease, breathing first becomes a problem during sleep, when breathing normally slows and the weak respiratory muscles cannot keep up with the need to eliminate carbon dioxide. The rising carbondioxide affects the acid–base balance of the body, and, in extreme cases, It could cause coma or even death.

Critical care is often described as expensive care. However, standardized methodology that would enable determination and international comparisons of cost is currently lacking. This article attempts to review this important issue and develop a framework through which cost of critical care in India could be analyzed. The cost of critical care is widely recognized as being both expensive and increasing remains a challenge to accurately assess the cost of intensive care due to lack of standardized methodology. There is also considerable heterogeneity between countries and even within the country in allocation of resources and distribution of critical care services and cost of personnel and price of drugs. The indivisibility and intangibility of several

health care outcomes is also a concern, particularly while evaluating cost effectiveness. More importantly, when it comes to health care needs, the emotions and ethics of the society is often compelling and most are willing to accept the cost even in situations where effectiveness is not clearly established.

. The newest ICU set up emerging in some advanced tertiary care hospitals is the emergency or acute care units, located in the casualty or emergency departments. These emergency intensive care units cater to first 24 hours of aggressive treatment, monitoring and stabilization of diverse emergencies, and seem to have significantly reduced the mortality, especially in patients with Acute Myocardial Infarction, Cerebrovascular Stroke, Adult Respiratory Distress Syndrome (ARDS) arising out of diverse etiologies and poisonings.

There are few critical care units in the country that are well equipped and have the expertise to use modern, sophisticated technology to the patient's advantage. Many units are poorly equipped for economic reasons, and a few units are reasonably well equipped but lack the comprehensive equipment and/or the expertise to use it with efficiency and discretion. The scenario is slowly changing for the better in terms of technology and expertise.

The state of Tamil Nadu there are tertiary level care yielding Government hospitals equipped with well furnished intensive care units where majority of the patients are mechanically ventilaetd and resuscitated. The Goverrntment Rajaji hospital is center of excellence in south Tamil Nadu for rendering tertiary care. It serves as a tertiary level referral hospital to all the medical college hospitals of south Tamil Nadu.. It provides tertiary care with the comprehensive health insurance scheme by the government of Tamil Nadu. It has numerous intensive care unit to

render intensive care to the critically ill patients. Inorder to resuscitate the patients, patients are being intubated and ventilated on mechanical ventilation.

The Intensive Medical Care Unit, in Government Rajaji Hospital, Madurai has thirteen bed and out of thirteen bed approximately six to even beds will be occupied by intubated patients. When the patients were intubated and were on mechanical ventilator maintaining a clear airway is very important and which can be achieved only by meticulous proper endotracheal suctioning.

Endotracheal suctioning is an Group to remove accumulated mucus from the endotracheal tube, trachea, and lower airways in patients who are intubated and on mechanical ventilation. Intubation and mechanical ventilation impair the transport of mucus in the airways, and interfere with effective expectoration by coughing since the glottis cannot be closed. This has been the rationale behind the practice of applying routine endotracheal suctioning to these patients. Traditionally, endotracheal suctioning consists of disconnecting the patient from the ventilator, applying manual hyperinflation (“bagging”), inserting a suction catheter into the endotracheal tube and airways, and applying negative pressure to remove accumulated mucus. The procedure is essential for the stability of pulmonary function, as the presence of a ventilatory prosthesis interferes in the physiology of coughing and of the mucociliary system, which can inviabilize the adequate clearance of secretions from the trachea bronchial tree and cause stasis of this content. This can cause infections, respiratory compromise, obstruction of the endotracheal tube, hemodynamic changes and death. Endotracheal suctioning (ETS) is one of the most common procedures performed in patients with artificial airways. It is a component of bronchial hygiene therapy and mechanical ventilation that involves the mechanical aspiration of pulmonary secretions from a patient’s artificial airway to prevent its obstruction. In intensive care

units the health care professionals often uses normalsaline and sodiumbicorbonate as mucolytic agents rather than doing plain endotracheal suctioning. By doing proper endotracheal suctioning it is possible to maintain clear airway which will increase the oxygenation and reduce the labor of breathing, the occurrence of hypoxia and respiratory acidosis. When the airway is maintained patent by proper endotracheal suctioning the patients can be easily weaned from the ventilator if the respiratory parameters remained stable and the post extubation days will be less complicated and chances for reintubation is very less due to the removal of stagnation of secretion. So to maintain a patent airway by suctioning is very, very important in achieving proper oxygenation. It is very essential to remove the tenacious thick secretions and to improve the airway clearance .So the researcher intended to do the study on endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Goverrntment Rajaji Hospital Madurai. So the researcher intended to do the study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Goverrntment Rajaji Hospital Madurai.

1.2 Statement of the Problem

A study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

1.3 Objectives of the Study

- To assess the level of airway clearance among the intubated patients in both group 1 and group 11at Government Rajaji hospital, Madurai.

- To evaluate the effectiveness of endotracheal suctioning in Group I without normal saline and in Group II with normal saline on airway clearance among intubated patients at Government Rajaji hospital, Madurai.
- To compare the effectiveness between endotracheal suctioning in group I without normal saline and in groupII with normal saline on airway clearence among intubated patients at Government Rajaji hospital, Madurai.
- To associate the level of airway clearance among GroupI and Group II intubated patients at G.R.H Madurai with their selected socio demographic and clinical variables.

1.4 Hypotheses

H_1 - There is a significant difference between the pretest and post test scores between Group I and Group II after endotracheal suctioning on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

H_2-There is a significant difference between post test scores in Group I and Group II after endotracheal suctioning on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

H_3 - There is a significant association between the level of airway clearance among intubated patients at Government Rajaji hospital, Madurai with their selected socio demographic data and clinical variables.

1.5 Operational Definitions

Effectiveness

In this study it refers to the outcome of endotracheal suctioning without normal saline for Group I and with normal saline for Group II on airway clearance, which is measured through structured observational check list.

Endotracheal suctioning with normal saline

In this study it refers to the insertion of suction catheter in to the endotracheal tube approximately 0.5 -1cm beyond the length of the endotracheal tube by applying a negative pressure around 100mm of Hg. which is adjusted in the pressure gauge of the portable suction apparatus, and by instilling 5 ml of normal saline by disposable syringe in to the endotracheal tube prior to suctioning and applying suctioning for about 10 to 15 seconds and withdrawing the suction catheter in a rotatory manner to remove the accumulated secretion for maintaining a patent airway that causes effective ventilation and oxygenation.

Airway clearance

In this study it refers to the lung fields, airways and trachea will be free of secretion after endotracheal suctioning with normal saline or without normal saline and it will be assured by heart rate, oxygen saturation, respiratory rate, absence of dysphonea and clear lung fields.

Intubated patients

In this study Intubated patients refers to the patients those who are having endotracheal tube into the trachea for artificial ventilation with the help of a mechanical ventilator.

Government Rajaji hospital

In this study Government Rajaji hospital refers to tertiary care hospital that provides meticulous care to the people from southern part of the Tamil Nadu. It has all the facilities for rendering critical care to the various critical patients who are intubated and ventilated.

1.6 Assumptions

Intubated patients may have varying level of retention of sputum in the airways due to impaired mucociliary clearance.

1.7 Delimitaton

This study is limited to Intubated patients admitted in intensive medical care unit at Government Rajaji Medical College Hospital, Madurai. Data collection limited to the period of 4 to 6 weeks.

1.8 Projected Outcome

Endotracheal suctioning with normal saline will remove the secretion more effectively than without normal saline.

Review of Literature

CHAPTER II

REVIEW OF LITERATURE

Researchers generally undertake a literature search to familiarize themselves with a knowledge base. A review of related literature is an integrate component of any scientific approach. It involves a systematic identification, location, scrutiny and summary of written materials that contain information on a research problem.

A review of literature helps to assess what is already known, what is still unknown and untested, justify the need for its replication throw some light on the feasibility of the study and problems that may be encountered. It also helps to involve promising methodological tools, which sheds light on ways to improve the efficiency of data collection and obtain useful information on how to increase the effectiveness of data analysis.

The overall process of review of literature is to develop a strong knowledge base to carry out research and other scholarly educational and clinical practice activities. It helps to determine the gaps consistencies and inconsistencies in the literature about the particular subject under study.

The related literature is reviewed from the published and unpublished articles and Medline and internet search to broaden the understanding and insight in to the selected problem under the study. This review of literature is a broad overview of studies, which are organized chronologically and arranged under the following sections.

REVIEW OF LITERATURE

This chapter is divided into two parts

PART - I

Section 1: Review of literature related to endotracheal intubation.

Section 2: Review of literature related to endotracheal suctioning

Section 3: Review of literature related to endotracheal suctioning with normal saline

PART - II

Conceptual Framework

PART—1

2.1 Section -1 - Review of literature related to endotracheal intubation.

Sean P. Keenan. etal., (2013) conducted a randomized, controlled trial (RCT) study on Which Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease Benefit from Noninvasive Positive-Pressure Ventilation. A Systematic Review of the Literature examining the use of NPPV in patients with acute exacerbations of COPD 9, found a mortality benefit after excluding patients who did not tolerate the treatment. Since then, several other RCTs have reported inconsistent effects of NPPV on mortality rates (10-23). Apparent differences in trial outcomes, such as endotracheal intubation, length of hospital stay, and hospital survival, raise questions about the actual effectiveness of NPPV for patients with acute exacerbations of COPD.

Josephine V Lightowler.etal.,(2014) conducted a systematic review of randomized controlled trials to determine the effectiveness of non-invasive positive pressure ventilation (NPPV) in the management of respiratory failure secondary to

acute exacerbation of chronic obstructive pulmonary disease. Systematic review of randomized controlled trials that compared NPPV and usual medical care with usual medical care alone in patients admitted to hospital with respiratory failure resulting from an exacerbation of chronic obstructive pulmonary disease and with PaCO2 >6 kPa. The eight studies included in the review showed that, compared with usual care alone, NPPV as an adjunct to usual care was associated with a lower mortality (relative risk 0.41 (95% confidence interval 0.26 to 0.64)), a lower need for intubation (relative risk 0.42 (0.31 to 0.59)), lower likelihood of treatment failure (relative risk 0.51 (0.38 to 0.67)), and greater improvements at 1 hour in pH (weighted mean difference 0.03 (0.02 to 0.04)), PaCO2 (weighted mean difference −0.40 kPa (−0.78 to −0.03)), and respiratory rate (weighted mean difference −3.08 breaths per minute (−4.26 to −1.89)). NPPV resulted in fewer complications associated with treatment (relative risk 0.32 (0.18 to 0.56)) and shorter duration of stay in hospital (weighted mean difference −3.24 days (−4.42 to −2.06)).

2.2 Section-2-Review of literature related to endotracheal suctioning

Hossein Tavangar. et al., (2016) conducted a prospective clinical trial on the Effect of the Duration of Pre-Oxygenation before Endotracheal Suction on Hemodynamic Symptoms on 63 eligible ICU patients under mechanical ventilator. Subjects randomly divided into three groups. Pre-oxygenation was carried out for 30 seconds in the first group for one minute in the second group and for two minutes in the third group. All three groups were then hyper-oxygenated for one minute. Arterial oxygen saturation and heart rate were recorded on different occasions in the three groups. The data obtained were analyzed using the ANOVA, the one-way ANOVA, the post-hoc test and the repeated measure ANOVA. The results obtained showed a greater reduction in the mean O2sat during the suctioning episodes in the 30-second

pre-oxygenation group compared to in the one-minute (P=0.046) and two-minute (P=0.001) pre-oxygenation groups. This mean reduction was also observed immediately after suctioning (P=0.001). The mean O2sat was lower in the 30-second pre-oxygenation group than in the one-minute pre-oxygenation group in minutes 5 (P=0.002) and 20 (P=0.001) of the suctioning. Similarly, the mean O2sat was lower in the 30-second pre-oxygenation group than in the two-minute pre-oxygenation group in minutes 5 (P=0.001) and 20 (P=0.001) of the suctioning. The results obtained through the ANOVA showed the lack of significant differences between the three groups in the mean variation in heart rate in the different stages of suctioning. According to the results obtained, one-minute and two-minute pre-oxygenations cause less disruption in arterial oxygen saturation compared to a 30-second pre-oxygenation. To achieve stability in arterial oxygen saturation and avoid hypoxemia caused by endotracheal suctioning, one-minute or two-minute pre-oxygenation is recommended in ICUs depending on the patient's clinical conditions.

ML Sole. (2015) conducted a descriptive, comparative study to identify which assessments were best indicated for endotracheal suctioning in three critical care units (medical-surgical, trauma and neurological). The study enrolled a final sample of 42 adult patients under traditional mechanical ventilation, with a ventilator disposing of a waveform display. Assessments were performed every hour after inclusion by 1 or 2 investigators, following a checklist derived from the AARC guidelines. The ventilators waveforms routinely monitored were the scalars for flow, volume and pressure, commonly used for detection of a saw tooth pattern. The mean time to endotracheal suctioning was 2 hours (1-4), and a total of 2 to 4 passes were necessary to clear secretions. Indicators for endotracheal suctioning were identified in 93% of the patients, mainly, coarse crackles over the trachea (37 patients, 88%); sawtooth

pattern on the flow-time waveform was detected in 14 patients (33%) and coughing in 12 (29%).

Caroline J. Wood. Conducted a study at Intensive Care Unit, Pilgrim Hospital, Boston, Endotracheal suctioning (ETS) is a necessary practice carried out in intensive care units. It involves the removal of pulmonary secretions from a patient with an artificial airway in place. All intensive care nurses should be aware when performing this Group of the potential hazards a patient is exposed to, and should endeavour to prevent or minimize these. This literature review explores the criteria available to indicate a need for ETS and discusses the potential adverse effects of ETS and how these can be avoided during the procedure. The recognition that ETS is a necessary procedure to maintain a patent airway and clear secretions.

A. Odell. Conducted a review of the literature regarding Endotracheal suction for adult, non-head-injured, patients. Endotracheal suction, when performed in the unit, appeared to be carried out according to the nurses' experience and expertise, and had no formal research backing. An extensive literature search was undertaken, and a framework for endotracheal suction was formulated based on the available evidence. Some of the aspects of endotracheal suction represented in the research evidence appear contradictory, and nurses must make a professional judgment about their suction technique based on the individual circumstances of patients. The wealth of evidence available regarding endotracheal suctioning allows nurses to make an informed decision about care.

Carsten M.Pedersen (2008) Intubated patients may be unable to adequately cough up secretions. Endotracheal suctioning is therefore important in order to reduce the risk of consolidation and atelectasis that may lead to inadequate ventilation. The suction procedure is associated with complications and risks including bleeding,

infection, atelectasis, hypoxemia, cardiovascular instability, elevated intracranial pressure, and may also cause lesions in the tracheal mucosa. The aim of this article was to review the available literature regarding endotracheal suctioning of adult intubated intensive care patients and to provide evidence-based recommendations The major recommendations are suctioning only when necessary, using a suction catheter occluding less than half the lumen of the endotracheal tube, using the lowest possible suction pressure, inserting the catheter no further than carina, suctioning no longer than 15 s, performing continuous rather than intermittent suctioning, avoiding saline lavage, providing hyper oxygenation before and after the suction procedure, providing hyperinflation combined with hyper oxygenation on a non-routine basis, always using aseptic technique, and using either closed or open suction systems.

Sanja Jelic.etal.,(2008) conducted A clinical review Clinical review on Airway hygiene in the intensive care unit Maintenance of airway secretion clearance, or airway hygiene, is important for the preservation of airway patency and the prevention of respiratory tract infection. Impaired airway clearance often prompts admission to the intensive care unit (ICU) and can be a cause and/or contributor to acute respiratory failure. Physical methods to augment airway clearance are often used in the ICU but few are substantiated by clinical data. This review focuses on the impact of oral hygiene, tracheal suctioning, bronchoscopy, mucus-controlling agents, and kinetic therapy on the incidence of hospital-acquired respiratory infections, length of stay in the hospital and the ICU, and mortality in critically ill patients. Available data are distilled into recommendations for the maintenance of airway hygiene in ICU patients

Favretto.etal., (2015) conducted a study on Endotracheal suction in intubated critically ill adult patients undergoing mechanical ventilation a systematic review

identify and analyze in the literature the evidence of randomized controlled trials on care related to the suctioning of endotracheal secretions in intubated, critically ill adult patients undergoing mechanical ventilation. the search was conducted in the PubMed, EMBASE, CENTRAL, CINAHL and LILACS databases. From the 631 citations found, 17 studies were selected. Evidence was identified for six categories of Group related to endotracheal suctioning, which were analyzed according to outcomes related to hemodynamic and blood gas alterations, microbial colonization, nosocomial infection, and others.

Atefeh ghanbari. Etal(2014) conducted A study on Effect of Endotracheal Suctioning with and without Normal Saline on Hemodynamic and Respiratory Parameters in Patients Undergoing Mechanical Ventilation in ICU of Hospitals Supervised by Guilan University of Medical Sciences. Airway suction is one of the most popular methods for drainage airways in patients with artificial airway; thus, correct suction of airways is important. Hence, the purpose of this study is to determine the effects of suction methods with and without normal saline on hemodynamic and respiratory patients. This randomized crossover clinical trial was conducted on two groups consisting of 37 mechanically ventilated patients by suctioning with and without normal saline. After at least 2 hours, the second stage was conducted and the patients were displaced in groups A and B. respiratory and hemodynamic parameters were measured at different intervals. The average age of patients was 21.8 ± 51.2; in terms of consciousness, 70% of patients were Sedate. Systolic blood pressure ($P = 0.20$), diastolic blood pressure ($P < 0.0001$), average arterial pressure ($P < 0.0001$) and heart rate ($P < 0.0001$) increased over time immediately after the suction and then declined; in approximately 5 minutes after suction, it approached its baseline.

2.3 Section-3-Review of literature related to endotracheal suctioning with normal saline

Ayhan H.et.al., (2015) conducted a systematic review and a descriptive study to systematically review studies that investigated the effects of normal saline instillation before endotracheal suctioning and to determine the views of nurses concerning this procedure in two stages. In the first stage, the Medline and CINAHL databases were searched. The second stage of the study consisted of a survey of 65 intensive care nurses. The systematic review identified 7 studies. Nearly all of the studies had a self-controlled clinical trial design. Normal saline instillation before endotracheal suctioning was demonstrated to decrease patient oxygenation in most studies ($P < .05$). However, the impact of normal saline on hemodynamics and the incidence of ventilator-associated pneumonia remain unclear.

Akgül S, Akyolcu N. (2010) conducted an experimental study to determine the effects of saline solution administered prior to endotracheal suctioning by nurses working in intensive care on oxygenation, heart rate and long-term pulmonary hygiene. The study was carried out on an experimental basis in the Intensive Care Unit of a university hospital in Turkey. A total of 20 patients were included, who were mechanically ventilated because of pulmonary or cardiovascular problems or trauma. Data were collected using a data form. Each patient was monitored for 5 minutes following suctioning with or without saline solution and findings of heart rate, SpO2, and blood gas measurements were recorded. Data were analyzed using percentage calculations, the student's t-test and the Friedman test. The study showed that most of the patients were between 60 and 69 years and were intubated because of respiratory insufficiency. Evaluation of blood gases following suctioning with or without saline solution showed partial decreases in pO2, pCO2, HCO3, and oxygen

saturation (SaO2), which did not reach a significant level. No significant difference was found between pH levels recorded prior to and 5 minutes after suctioning without saline solution; however, the increase in pH following suctioning with saline solution was significant. Patients undergoing suctioning with saline solution exhibited significantly increased heart rates in the fourth and fifth minutes, whereas no increases were detected in these undergoing suctioning without saline solution. SpO2 values obtained by pulse oxymeter did not show significant differences. Saline solution administered with suctioning resulted in undesirable, although not significant, alterations in oxygen saturation and arterial blood gas levels.

Kinloch D.(2000) conducted a descriptive study observational study To describe the effects of instillation of normal saline into an endotracheal tube before suctioning on mixed venous oxygen saturation in critically ill adult patients. 35 patients were assigned to either of 2 groups after coronary artery bypass grafting. One group had 5 mL of normal saline instilled at the start of endotracheal tube suctioning; the other group had the same endotracheal tube suctioning procedure without the use of saline. Data on mixed venous oxygen saturation were recorded at 1-minute intervals for a 5-minute baseline period and then throughout the suctioning procedure until mixed venous oxygen saturation returned to baseline levels. The time required for mixed venous oxygen saturation to return to baseline values after suctioning was an average of 3.78 minutes longer when saline was used.

Ridling DA.et al ., (2009) conducted a study to describe differences in oxygen saturation depending on whether or not isotonic sodium chloride solution is instilled during suctioning and (2) to describe the rates of occlusion of endotracheal tubes and nosocomial pneumonia. A convenience sample of 24 critically ill patients were enrolled before having suctioning and after informed consent had been given. Ages

ranged from 10 weeks to 14 years. Patients were randomized to 1 of 2 groups. In group 1, subjects received between 0.5 and 2.0 mL of isotonic sodium chloride solution, depending on their age, once per suctioning episode. In group 2, subjects received no such solution. A total of 104 suctioning episodes were analyzed. Oxygen saturation was recorded at predetermined intervals before and for 10 minutes after suctioning. Occlusion of endotracheal tubes and rates of nosocomial pneumonia also were compared. Patients who had isotonic sodium chloride solution instilled experienced significantly greater oxygen desaturation 1 and 2 minutes after suctioning than did patients who did not. No occlusions of endotracheal tubes and no cases of nosocomial pneumonia occurred in either group.

Caruso P. et al., (2009) conducted Randomized clinical trial to compare the incidence of ventilator-associated pneumonia (VAP) with or without isotonic saline instillation before tracheal suctioning in a medical surgical intensive care unit of an oncologic hospital. They selected consecutive patients needing mechanical ventilation for >72 hrs. Patients were allocated into two groups: a saline group that received instillation of 8 mL of saline before tracheal suctioning and a control group which did not. VAP was diagnosed based on clinical suspicion and confirmed by broncho alveolar lavage quantitative culture. The incidence of atelectasis on daily chest radiography and endotracheal tube occlusions were recorded. The sample size was calculated to a power of 80% and a type I error probability of 5%.One hundred thirty patients were assigned to the saline group and 132 to the control group. The baseline demographic variables were similar between groups. The rate of clinically suspected VAP was similar in both groups. The incidence of microbiological proven VAP was significantly lower in the saline group (23.5% x 10.8%; $p = 0.008$) (incidence density/1.000 days of ventilation 21.22 x 9.62; $p < 0.01$). Using the Kaplan-Meier

curve analysis, the proportion of patients remaining without VAP was higher in the saline group (p = 0.02, log-rank test). The relative risk reduction of VAP in the saline instillation group was 54% (95% confidence interval, 18%-74%) and the number needed to treat was eight (95% confidence interval, 5-27). The incidence of atelectases and endotracheal tube occlusion were similar between groups.

Mireia Llaurado Serra.(2015) prepared Article review regarding the procedure of the Normal Saline Instillation (NSI). The article from Ayhan et al. (1), describes a two part study wherein they first performed a systematic review of the effects of NSI before endotracheal suctioning. Secondly, they surveyed 65 registered nurses (RN) from 4 intensive care units (ICU) from their hospital to evaluate its use in clinical practice. Similarly, Leddy et al. (2), analysed the endotracheal suctioning procedure from 83 RN and 87 registered respiratory therapists (RRT) using a questionnaire in 6 intensive care units. In the systematic review, Ayhan and colleagues (1), analysed only 7 articles, focusing the following issues: impact on sputum amount, impact on oxygenation, on haemodynamics, on pulmonary infection and NSI distribution in the lungs. They resolved that there is sufficient evidence to conclude that NSI before endotracheal suctioning, which is used to soften an easily remove secretions, significantly decreases the patient's oxygenation. However, the impact of NSI on the sputum amount, haemodynamics and ventilator-associated pneumonia incidence remains controversial. Regarding the use of NSI both authors found similar results. Most professionals generally use the NSI before endotracheal suctioning. The amount of normal saline used is most frequently less than 5 ml. When asking for the reason to use NSI, most healthcarers responded to liquefy the secretions (1,2) or multiple reasons.

Jennifer Paratz. (2015) conducted A review of article to investigate the efficacy and safety of the technique of instillation of normal saline prior to suction of airways in intubated patients at research Centre, Department of Intensive Care Medicine, University of Queensland. Databases searched included: MEDLINE, CINAHL, EMBASE,. Citation tracking of relevant primary and review articles. All randomised controlled trials, crossover trials, quasi- and full systematic reviews were screened. From 65 articles screened, 17 articles (two quasi-systematic reviews and 15 empirical studies) met the eligibility criteria and were included for data extraction. The outcomes in the reviewed studies included oxygenation, lung mechanics, sputum yield, dyspnoea, tube patency and ventilator-associated pneumonia. Effect sizes and 95% confidence intervals were calculated. Studies were mainly of low methodological quality due to factors such as lack of assessor blinding and within-group-only statistics. Overall, there was a positive effect favouring the use of saline to increase sputum yield (d=0.50, 95% confidence interval 0.10 to 0.90). Due to heterogeneity of methodology, it was not possible to perform meta-analyses on haemodynamics, oxygenation, tube patency and ventilator-associated pneumonia.

Conceptual frame work

A conceptual frame work is a theoretical approach to study the problems that are scientifically based and emphasis the selection, arrangement and classification of its concept. Concepts are words that depict objects, properties or events and are the basic components of theory. The conceptual frame work in a general amalgam of all the related concepts in the problem area.

Conceptual frame work deals with abstraction or concepts that are assembled by virtue of their relevance to a common theme. Conceptualization is a process of forming ideas which are utilized and forms conceptual frame work for development of

research design. It helps the researchers by giving direction to go about the entire research process.

The conceptual frame work of this study is based on Orem's self-care theory.Dorothea Elizabeth Orem-America's foremost Nursing Theorist, is a curriculum consultant. She found deficit in the training of practical nurses. As a result, she published guidelines for developing curricula for the education of practical nurses. Orem (1991) identified three classifications of nursing system to meet self care requisites of the patient. Those systems are:

- The wholly compensatory system.
- The partial compensatory system.
- The supportive educative system.

In this study the critically ill patients requires "The wholly compensatory system".

The wholly compensatory system

This system is represented by a situation in which the individual is unable to engage in self care actions requiring self directed and controlled ambulation and manipulative movement or the medical prescription to refrain from self care activity. Persons with health limitations are socially dependent on others for their continued existence and wellbeing. Concepts of the wholly compensatory system are:

- Accomplishes patient's therapeutic self care.
- Compensates for patients inability to engage in self care.
- Support and protects patient.

Orem (1991) enumerated five areas of activity for nursing practice. They are as follows

Self care-self care is the learned, goal oriented activity of individual. Adult care for themselves, whereas infants, the aged, the ill and the disabled require assistance with self care activities, when self care action is limited because of health deviation.

Self care agency- Self care agency is a learned ability and is a deliberate action. Human need continuous self care maintenance and regulation and it is provided by caring for self, which enables purposeful action. Self activities maintain life, health and well being. Nurse must focus on limitations in self care abilities and must accurately diagnose self-care agency.

Self care demands – Demands or requesties are the activities of daily living. Self care requisites can be defined as actions directed toward the provision of self care.

Three kinds of requisites are mentioned, they are universal, development and health deviation.

Deficit- Nursing agency is required, when an individual is incapable of or limited in the provision of continuous effective self care.

Nursing agency- "Nursing agency is a continuing series of actions produced ,when nurses link one way or a number of ways of helping to their own actions or actions of persons under care that are directed to meet these persons therapeutic self care demands or to regulate their self-care agency"

In this study,

- Self care-Self care is the mucociliary clearance of secretion, which is a learnt behavior but not able to be performed by the intubated patients.
- Self care agency- The intubated patient's self care agency is altered and they are not able to continue their self care activities, which maintain their life, health and well being. Researcher found that intubated patients airway clearance should be performed by the nursing system.

- Self care demands- Health is deviated in the intubated patients critically ill patients. Activities of daily living (Mouth care) are the demands of the intubated patients.
- Deficit- continuous effective airway clearance is the Deficit in the intubated patients.
- Nursing agency- Researcher is the Nursing agency, who provided the Endotracheal suctioning in order to improve and maintain the airway clearance. The level of airway clearance is measured by using self structured observational check list before and after Endotracheal suctioning.

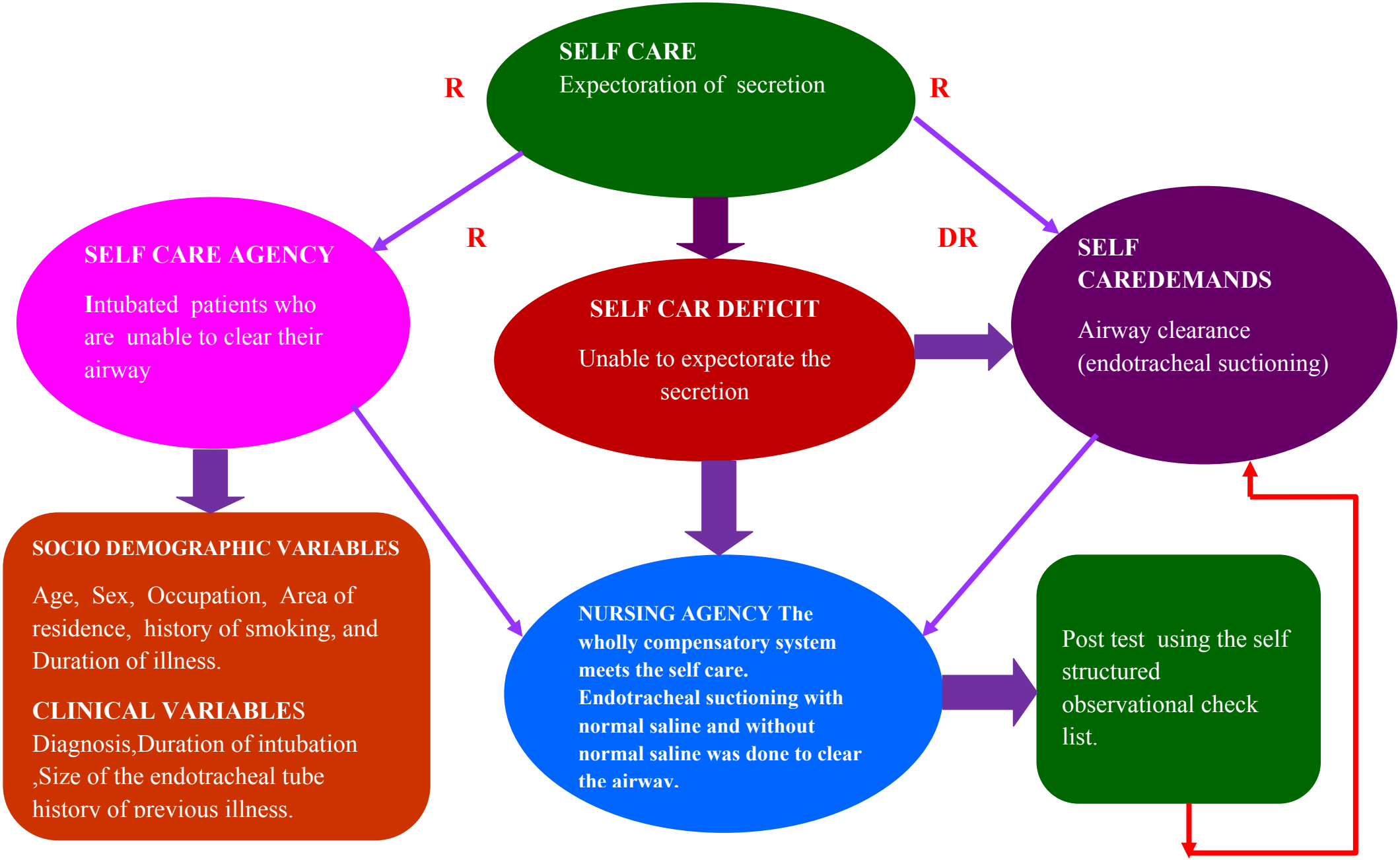

FIGURE NO.1. CONCEPTUAL FRAME WORK BASED ON MODIFIED OREM'S SELF CARE THEORY (1991)

Methodology

CHAPTER III

RESEARCH METHODOLOGY

Research methodology is a method to solve research problem systematically .the method used to structure a study, to gather and analyse information in a systematic fashion.

(Polit & Beck, 2011)

The methodology of the research indicates the general pattern of organizing the procedure of gathering valid and reliable data for the problem under investigation. This methodology of the study includes research approach, research design, variables, setting of the study population, sample and sampling technique, sampling criteria, development and description of the tool, content validity and reliability of the tool, procedure of instillation of normal saline and endotracheal suctioning, pilot study, data collection process, plan for data analysis and the protection of human rights on whole it gives a general pattern of gathering and processing the research data.

3.1 Research approach

The research approach tells the researcher from where the data to be collected, what to collect, how to collect and how to analyze them. It also suggests a possible conclusion and help the researcher in answering specific research questions in an accurate and efficient way.

In this study, Quantitative evaluative research approach was used.

3.2 Research design

The research design selected for this study was true experimental, pretest--post test design.

	Group	Pretest	Group	Post test
R	Group I	O_1	X_1 Endotracheal suctioning without normal saline	O_2
	Group II	O_1	X_2 Endotracheal suctioning with 5ml normal saline	O_2

R---- Randomization

O_1--- Observation before Group

O_2--- Observation after Group

Group 1—Subjects receiving endotracheal suctioning without normal saline

Group 11—Subjects receiving endotracheal suctioning with normal saline

X----- Group (X_1 Endotracheal suctioning without normal saline, X_2 Endotracheal suctioning with normal saline)

3.3 Research variables

Independent variable

Endotracheal suctioning with normal saline and endotracheal suctioning without normal saline.

Dependent variable

Level of airway clearance.

Socio- demographic variables.

Structured interview schedule with caregivers which is prepared by the researcher and validated by the experts. It consists of 6 number of items of socio demographic variables of age, sex, occupation, area of residence, history of smoking, and duration of admission.

Clinical variables

Clinical variables consists of diagnosis, duration of intubation, size of the endotracheal tube, and History of previous hospitalization observed by the researcher with observational check list

3.4 Settings of the study

The study was conducted in Intensive medical care unit, Government Rajaji Hospital, Madurai-20. It is a 3106 bedded multi specialty Medical College attached hospital and it provides comprehensive care to the sick and needy people. The hospital has a separate Intensive Medical Care Unit with all the excellent life saving facilities which has 13 beds 9 artificial respirators and life saving facilities. The unit has excellent facilities for providing meritorious intensive medical care for those who were having respiratory failure and also for the patients with serious medical conditions approximately 90-100 patients were transferred in to this from general ward and an average of 3-4 clients per day and bed occupancy ratio is 100%

3.5 Population

1. **Target population**

The target population comprises of clients intubated patients with mechanical ventilation.

2. Accessible population

The study population comprises of intubated patients with mechanical ventilation got admitted in Intensive medical care unit at Government Rajaji Hospital Madurai.

3. 6 Sample

Endotracheally intubated patients with mechanical ventilation got admitted in intensive medical care unit at Government Rajaji Hospital Madurai who meet the inclusion criteria.

3.7 Sample size

The sample size comprises of 60 intubated patients with mechanical ventilation

Group 1 -- 30

Group 11 -- 30.

3.8 .Sampling technique

The sampling technique used in this study was Non Probability (Consecutive sampling technique)

3.9 Criteria for sample selection

Inclusion criteria

- Intubated patients who were both conscious and unconscious .
- Those who were on SIMV(Synchronized intermittent mandatory ventilation) mode of ventilation.
- Both Male and Female intubated patients with mechanical ventilation.

Exclusion criteria

- Mechanically ventilated clients with tracheostomy.
- Those who were on mucolytic or nebulizer medications, bronchodilators, and hydrocortisone.

3.10 Development and description of the tool

The tool consists of three sections

Section A Socio demographic variables

Section B Clinical variables

Section C Structured observational check list

Section A

Structured interview schedule which is prepared by the researcher validated by Six experts. It consists of 6 number of items of socio demographic variables of age, sex, occupation, area of residence, history of smoking, and duration of admission in hospital.

Section B

Clinical variables consists of diagnosis, duration of intubation, size of the endotracheal tube, medication and history of previous hospitalization.

Section C

Structured observational check list for airway clearance, it consist of 5 items

S. No	Observational parameters	Score
1	Heart rate a) 70—85 b) 86—100 c) 101—115 d) Above115	 1 2 3 4
2.	Oxygen saturation a) 100—96% b) 95---91% c) 90—86% d) Below 86%	 1 2 3 4
3.	Respiratory rate a) 12—18 b) 19—25 c) 26—32 d) Above 32	 1 2 3 4
4.	Presence of dyspnoea a) No dyspnea b) Mild dysponea c) Moderate dysponea d) Severe dyspnoea	 1 2 3 4
5.	Auscultation of lung fields. a) Normal vesicular breath sounds b) wheezing c) fine crepts d) coarse crepts	 1 2 3 4

Scoring Procedure

S.No	Score	Level of airway clearance
1	**1—5**	**Well cleared**
2	**6—10**	**Moderately cleared**
3	**11—15**	**Minimally cleared**
4	**16—20**	**Very Minimally cleared**

3.11 Content validity

The tool and the content was corrected by Five experts in the field of Medicine and Medical surgical Nursing. The tool was modified according to the suggestion and recommendation of the experts and finalized by the guide.

3.12 Reliability of the tool

The reliability of the tool was done by Test --retest method (r=1). The reliability test score showed there was stability and consistency in the tool items .Hence the tool was considered highly reliable to the study.

3.13 Pilot study

A Pilot study was conducted in intensive medical care unit at government Rajaji hospital, Madurai, to test the feasibility, relevance and practicability of the Group from 6th march 2017 to 12th march 2017 among 10 intubated patients (5 in group 1 and 5 in group 11). Initially the subjects ,if not possible the care givers were explained about the study and informed consent was obtained . Subjects were selected by consecutive sampling technique. pretest on the airway clearance was done by using structured observational check list. Endotracheal suctioning without normal saline was done in Group group I and with normal saline was done in Group group II every second hourly and also on demand basis Ten minutes after the last suctioning at 7pm pot test was done by using the same structured observational check list .. The findings of the pilot study revealed that there was a significant difference in the level of airway clearance between both the groups .pilot study revealed that the study was feasible to proceed with the main study.

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3.14 Data collection procedure

. The researcher obtained formal permission from Ethical committee of Madurai Medical College, Madurai. The study was conducted for a period of 6 weeks from 20.3.17 to 30.4.17 in Intensive Medical Care Unit, Government Rajaji Hospital, Madurai. Rapport was established with the care givers and with the patients .Oral and written informed consent was obtained from the care givers of the subjects. 60 subjects were selected by Non probability (consecutive sampling) technique and assigned 30 subjects into groups I and 30 subjects into group II. Pre test was done on airway clearance in both the groups using structured observational check list Group endotracheal suctioning without normal saline for group1 and with normal saline to group 11 was done every second hourly and on demand basis by using appropriate suction catheter for ten to fifteen seconds with the negative pressure of 100 mm of hg and pre oxygenating with 100% oxygen .While inserting the blunt end suction catheter, pressure should not be applied by closing the two way and when the resistance of catheter is felt pressure should be released to suck out the secretion and the catheter should be removed in rotatory manner in order to prevent tissue injury. 10 minutes after the last endotracheal suctioning at 7pm (approximately between 7pm to 7.30 pm) post test was done with the same observational check list.

3.15 Ethical and Legal Consideration

This study was conducted after the approval of the ethics committee, Madurai Medical College, Madurai – 20. All the respondents were carefully informed about the purpose of the study and their part during the study and how the privacy was guarded. Confidentiality was ensured. Written permission was obtained from all participants.

3 .16 Plan for Data Analysis

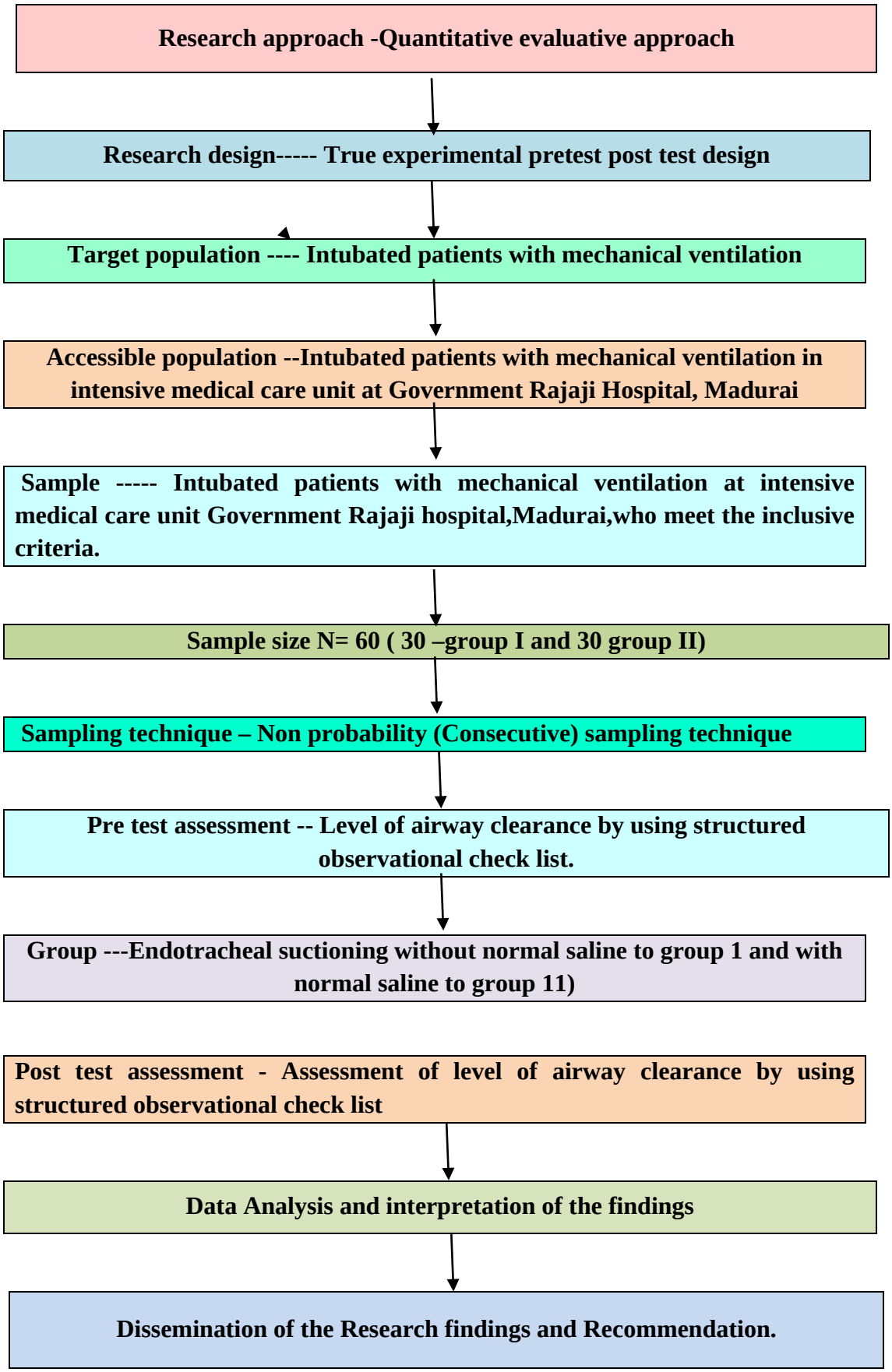
The data was analyzed according to objectives of the study by using descriptive and inferential statistics.

1. Frequencies and percentage was used for analyzing clinical variables, socio demographic variables.
2. Effectiveness of endotracheal suctioning on airway clearance between the pretest and post test level among group I and group II was tested by using a paired “t” test and effectiveness of endotracheal suctioning on airway clearance between the post test among group I and group II was tested by using an independent “t” test .
3. Chi-square analysis was used to find out the association between the level of airway clearance among intubated patients at Government Rajaji Hospital, Madurai and their selected socio demographic variables

Protection of human rights

1) The research proposal was approved by the dissertation committee, of college of Nursing, Madurai Medical College, Madurai, Government Rajaji hospital ethical committee, and from the head of the department of Medicine to conduct the main study.
2) Both verbal and written informed consent was obtained from care givers on intubated patient and the data collected was kept confidential.
3) Positive benefits were explained to all the caregivers.. They were also explained that they may withdraw from the study at any time without any penalty. The possible benefit of participating in the study was explained to the subjects if possible to the care giver and Anonymity and Confidentiality was maintained throughout the study.

3.17 Schematic presentation of methodology



Data Analysis And Interpretation

CHAPTER IV

DATA ANALYSIS AND INTERPRETATION

This chapter deals with the analysis of the data collected. Statistical procedure enabled the investigator to deduce, summarize, organize, evaluate, interpret and communicate the numeric information. Statistical analysis is a method of rendering quantitative information meaningful and intelligible. The goal of data analysis is to provide answers to the research questions. The plan for data analysis comes directly from the question, the design, the method of data collection and the level of measurement of the data. In this chapter the data collected were edited, tabulated, analyzed and interpreted.

The data collected were organized under the following sections

Section I

Distribution of socio demographic and clinical variables among intubated patients.

Section II

Description of level of airway clearance among intubated patients both in Group I and group11.

Section III

Effectiveness of endotracheal suctioning without normal saline in Group group1 and with normal in Group group 11 on airway clearance among intubated patients.

Section IV

Comparison of effectiveness between endotracheal suctioning without normal saline in Group group1 and with normal in Group group 11 on airway clearance among intubated patients.

Section V

Association between level of airway clearances among intubated and their socio demographic variables.

SECTION I

Distribution of subjects according to their socio demographic variables

TABLE -1

Frequency and percentage distribution of socio demographic variables among intubated patients

n=60

S. No	Socio Demographic variables		Group			
			Group –I (n=30)		Group II(n=30)	
			n	%	n	%
1.	**Age**	15 -30 years	12	40.0%	10	33.3%
		31 -45 years	6	20.0%	11	36.7%
		46 -60 years	6	20.0%	7	23.3%
		61 -75 years	6	20.0%	2	6.7%
2.	**Sex**	Male	19	63.3%	23	76.7%
		Female	11	36.7%	7	23.3%
3.	**Occupation**	Unemployed	17	56.7%	12	40.0%
		Farmer	5	16.6%	7	23.3%
		Private	2	6.7%	3	10.0%
		Government	4	13.3%	3	10.0%
		Industrial	2	6.7%	5	16.7%
4.	**Area of residence**	Town	14	46.7%	15	50%
		Village	16	53.3%	15	50%
5.	**History of smoking**	Non smoking	21	70.0%	20	66.6%
		1-5 years	2	6.6%	3	10.0%
		6-10 years	2	6.7%	2	6.7%
		11-15 years	2	6.7%	3	10.0%
		>15 years	3	10.0%	2	6.7%
6.	**Duration of admission in hospital**	1-3 days	19	63.3%	12	40.0%
		4 -6 days	5	16.7%	8	26.7%
		7 -9 days	3	10.0%	6	20.0%
		> 10 days	3	10.0%	4	13.3%

The above table 1 explains the distribution of intubated patients according to their socio – demographic variables.

Regarding Age, in group I majority 12 (40.0%), were between 15 - 30 years, 6 (20.0%) were between 31-45 years, 6 (20.0%) were between 46-60 years and 6 (20.0%) were between 61 - 75 yrs where as in group II the majority 11 (36.7.0%)

were between 31-45 years, 10 (33.3%), were more between 15 to 30 years, 7 (23.3%) were between 46-60 years and 2 (6.7%) were between 61 -75 yrs.

With regard to Sex**,** in group I majority 19 (63.3%) were males and remaining 11 (36.7%) were females where as in group II only 23 (76.7%) were males and remaining 7 (23.3%) were females.

By seeing Occupation in group I majority 17 (56.7%) were Unemployed, 5 (16.6%) were farmers, 2(6.7 %) were private employees, 4 (13.37%) were government employees, 2(6.7%) were industrial workers where as in group II majority 12(40%) were Unemployed, 7(23.36%) were farmers, 3(10.0%) were private employees, 3 (10%) were government employees, 5(16.7%) were industrial workers.

According to Area of residence, in group I majority 16 (53.3%) were from village, 14 (46.7%) were from town where as in group II 15 (50%) were from village, 15 (50%) were from town.

While viewing history of Smoking in group I majority 21 (70%) were non smokers, 3 (10%) were smoking for more than 15 years, 2 (6.7%) were smoking for 1-5 years, 2 (6.7%) were smoking for 6-10 years and 2 (6.7%) were smoking for 11-15 years where as in group II majority 20 (66.6%) were non smokers, 3 (10%) were smoking for 1-5 years, 3 (10%) were smoking for 11-15 years, 2 (6.7%) were smoking for more than 15 years.

While seeing Duration of admission in hospital in group I majority 19(63.3%) were having the history of 1-3 days of hospitalization, 5(16.7%) were having 4-6 days of hospitalization 3(10%) were having 7-9 days of hospitalization and 3(10%) were having more than 10 days of hospitalization where as in group II majority 12(40%) were from 1-3 days of hospitalization, 8(26.7%) were having history of 4-6 days of hospitalization 6(20%) were having 7-9 days of hospitalization and 4(13.3%) were having more than 10 days of hospitalization.

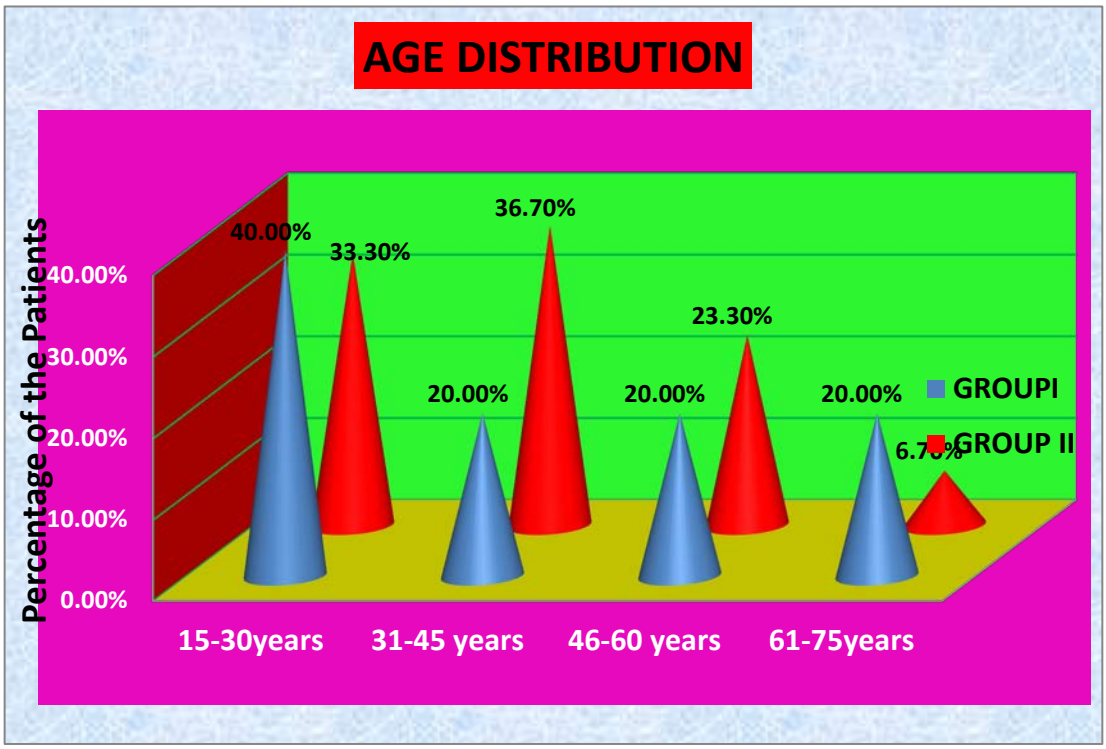


Figure – 1. Percentage distribution of age among intubated patients

The above 3 D Cone diagram depicted that regarding Age, in group I majority 12 (40.0%), were between 15 - 30 years, 6 (20.0%) were between 31-45 years, 6 (20.0%) were between 46-60 years and 6 (20.0%) were between 61 - 75 yrs where as in group II the majority 11 (36.7.0%) were between 31-45 years, 10 (33.3%), were more between 15 to 30 years, 7 (23.3%) were between 46-60 years and 2 (6.7%) were between 61 -75 yrs.

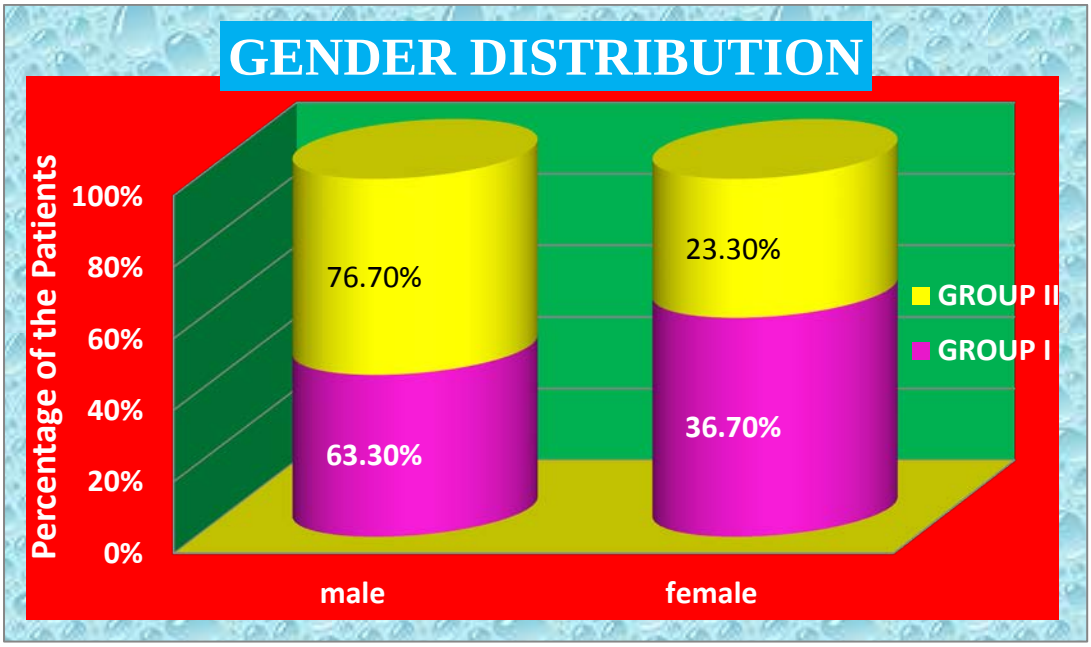


Figure - 2. Percentage distribution of gender among intubated patients

The above 100% stacked cylinder diagram revealed that with regard to Sex**,** in group I majority 19 (63.3%) were males and remaining 11 (36.7%) were females where as in group II only 23 (76.7%) were males and remaining 7 (23.3%) were females.

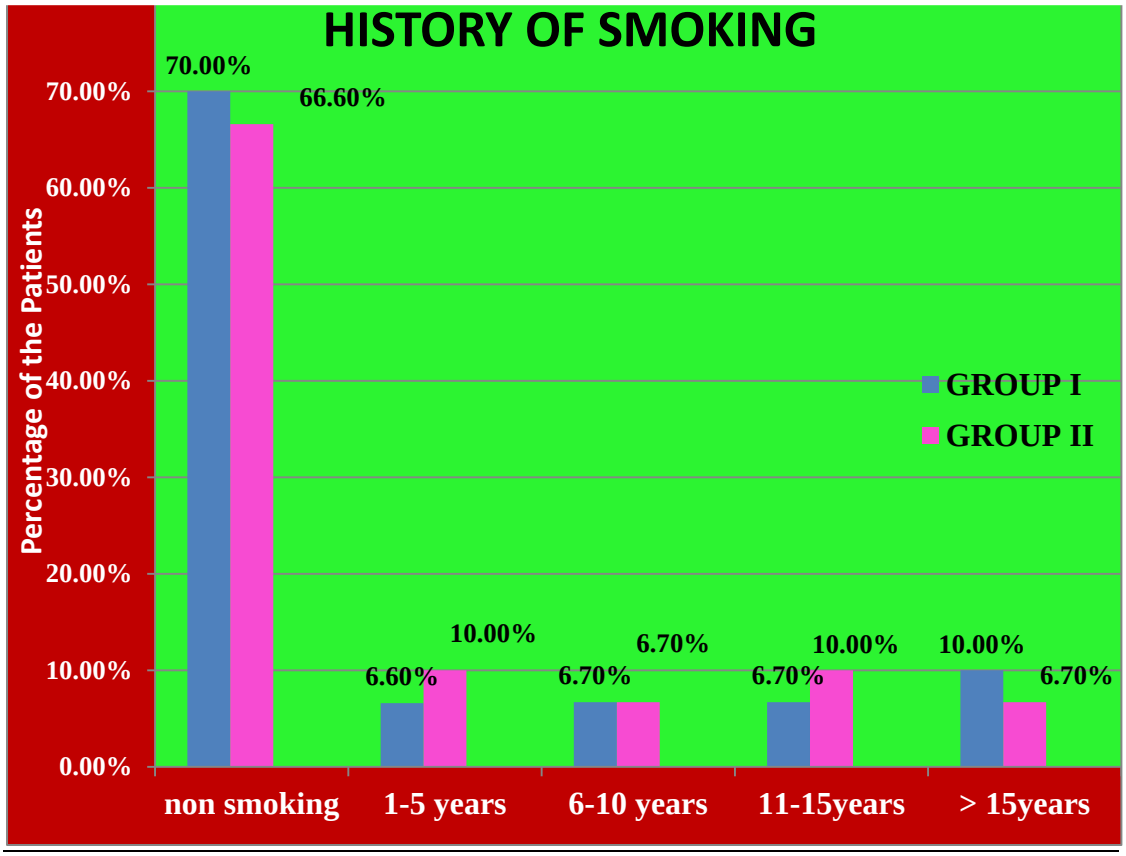


Figure – 5. Percentage distribution of history of smoking among intubated patients

The above clustered column diagram revealed while viewing that history of Smoking in group I majority 21 (70%) were non smokers, 3 (10%) were smoking for more than 15 years, 2 (6.7%) were smoking for 1-5 years, 2 (6.7%) were smoking for 6-10 years and 2 (6.7%) were smoking for 11-15 years where as in group II majority 20 (66.6%) were non smokers, 3 (10%) were smoking for 1-5 years, 3 (10%) were smoking for 11-15 years, 2 (6.7%) were smoking for more than 15 years.

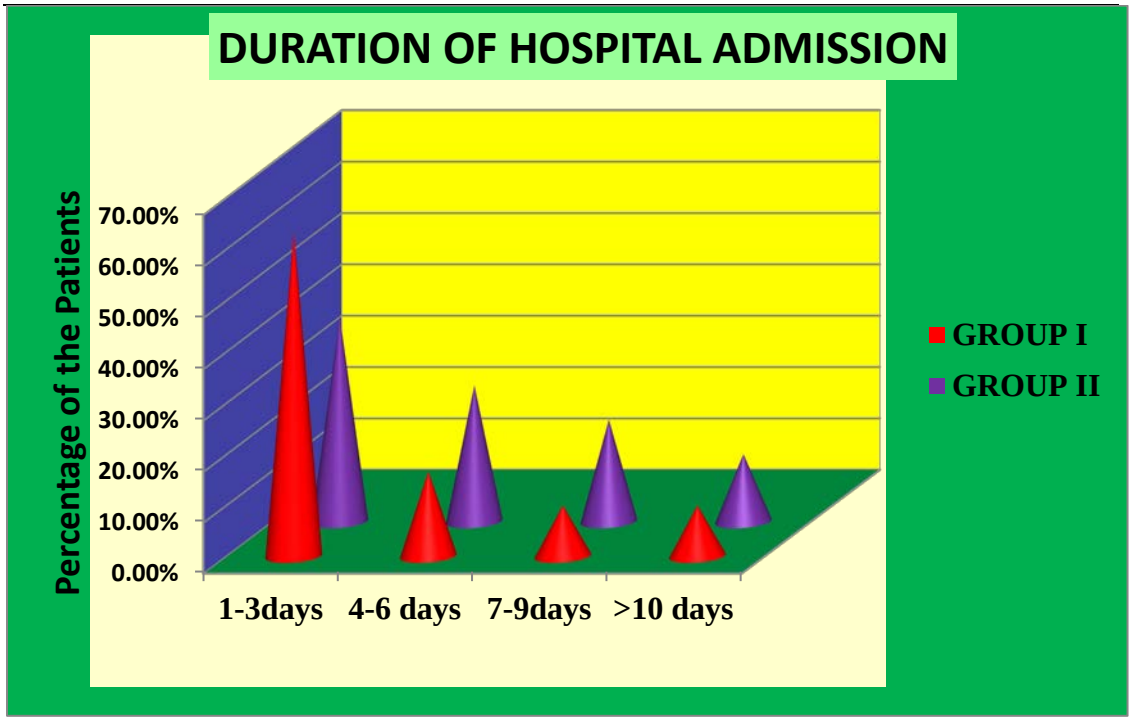


Figure – 6. Percentage distribution of duration of admission in hospital among intubated patients

The above 3D Cone diagram revealed that Duration of admission in hospital in group I majority 19 (63.3%) were having the history of 1-3 days of hospitalization, 5(16.7%) were having 4-6 days of hospitalization 3 (10%) were having 7-9 days of hospitalization and 3 (10%) were having more than 10 days of hospitalization where as in group II majority 12 (40%) were from 1-3 days of hospitalization, 8 (26.7%) were having history of 4-6 days of hospitalization 6 (20%) were having 7-9 days of hospitalization and 4 (13.3%) were having more than 10 days of hospitalization.

TABLE 2

Frequency and percentage distribution of clinical variables among intubated patients

n=60

Clinical variables		GROUPI I (n=30)		GROUP II n=30)		χ^2
		n	%	n	%	
Diagnosis	Medical	29	96.7%	30	100.0%	χ^2=1.02
	Surgical	1	3.3%	0	0.0%	P=0.31
	Others	0	0.0%	0	0.0%	DF=2 NS
Duration of intubation	1-3 days	27	90.0%	30	100.0%	χ^2=3.16P=0.08 DF=2 NS
	4-6 days	3	10.0%	0	0.0%	
	7 -9 days	0	0.0%	0	0.0%	
	>10 days	0	0.0%	0	0.0%	
Size of the E.T TUBE	6- 7.0 size	0	0.0%	0	0.0%	χ^2=1.22 P=0.06
	7- 8.5 size	29	96.7%	30	100.0%	DF=2 NS
	9- 9.5 size	1	3.3%	0	0.0%	
History of previous hospitalization	Within one year	8	26.7%	5	16.6%	χ^2=1.22 P=0.06
	2- 3 Year	5	16.7%	2	6.7%	DF=2 NS
	More than 3 years	4	13.3%	2	6.7%	
	Nil	13	43.3%	21	70.0%	

DF= Degrees of Freedom NS=not significant P>0.05 not significant

The above **t**able shows the clinical information of patients those who are participated in this study both in group I and group II.

Regarding Diagnosis, in group 1 majority 29 (96.7.0%), had medical problems and 1(3.3%) had surgical problems where as in group II all 30 (100%), had medical problems.

With regard to**,** duration of intubation in group I majority 27 (90%) were from 1-3 days and 3 (10%) were from 4-6 days where as in group 11 all 30 (100%) were from 1-3 days.

By seeing Size of the E,T tube in group 1 majority of intubated patients 29(9.7%) had 7-8.5 size E.T tube and 1 (3.3%) had 9-9.5 size E.T tube where as group 11 all 30(100%) had 7-8.5 size E.T tube.

According to the History of previous hospitalization in group 1 majority 13 (43.3%) had no history of previous hospitalization, 8(26.7%) had with in one year, 5(16.7 %) had within 2-3 years and 4(13.3 %) were with more than 3 years, where as in group 11 majority 21 (70%) had no history of previous hospitalization, 5(16.6%) had with in one year, 2(6.7 %) had within 2-3 years and 2(6.7%) had more than 3 years.

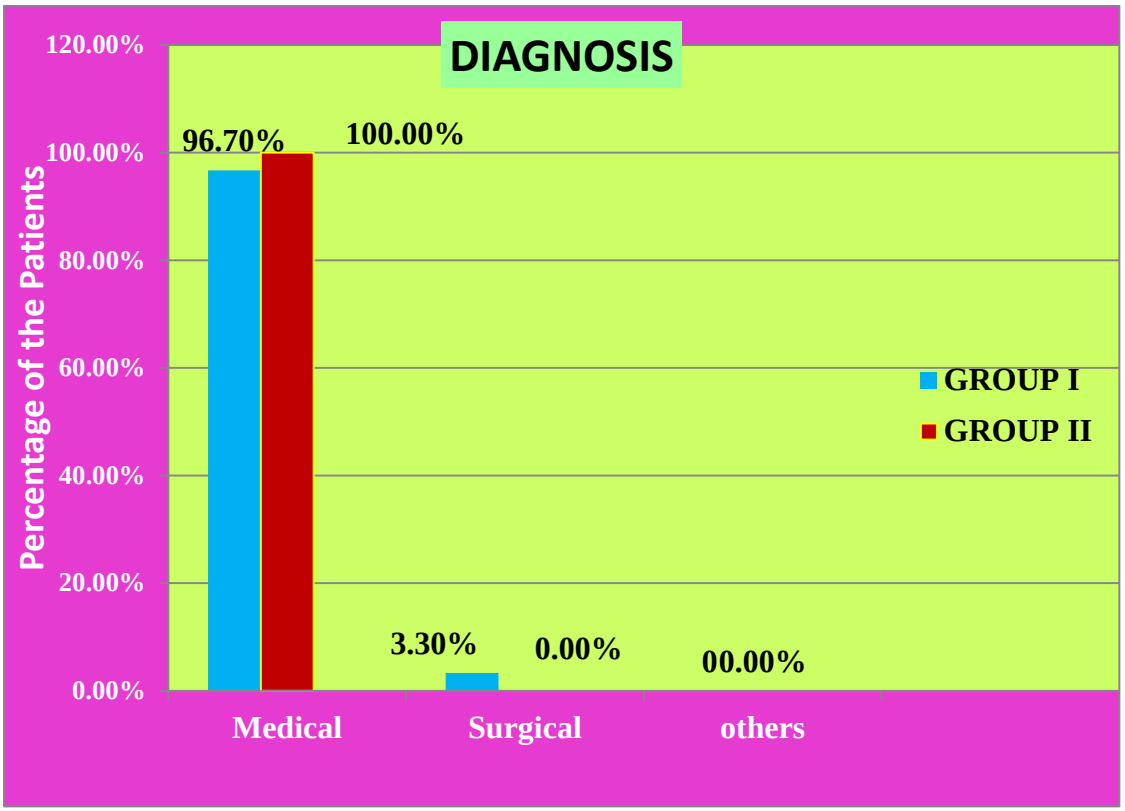


Figure 7 - Percentage distribution of diagnosis among intubated patients

The clustered column diagram revealed that in group 1 majority 29 (96.7.0%), had medical problems and 1(3.3%) had surgical problems where as in group II all 30 (100%), had medical problems.

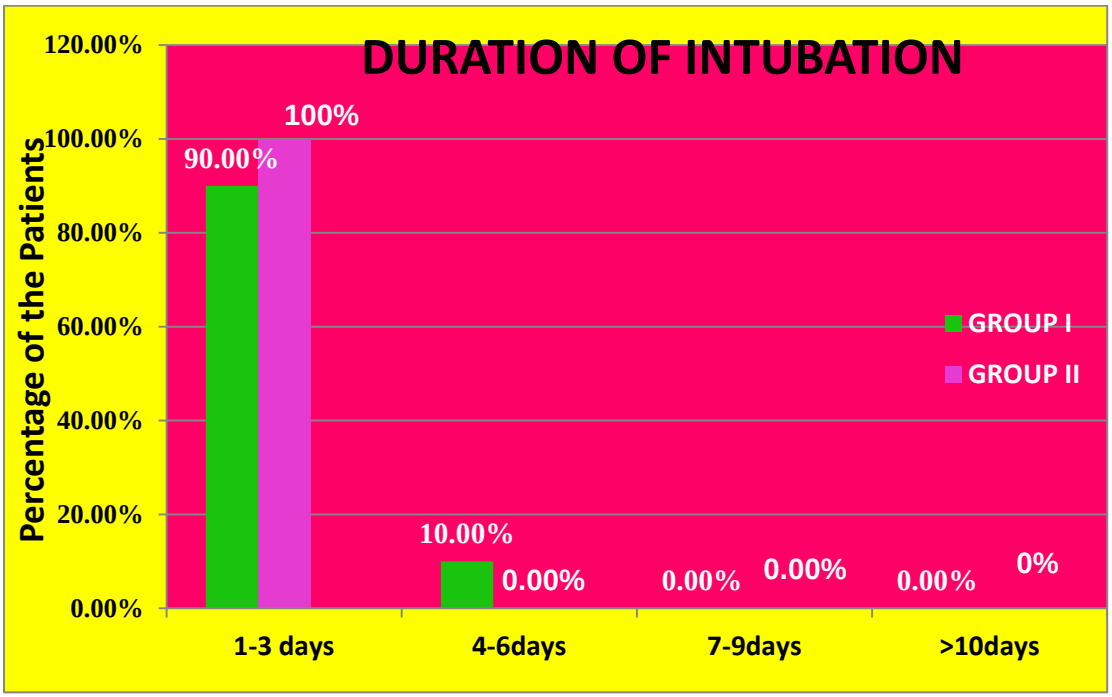


Figure – 8. Percentage distribution of duration of intubation among intubated patients

The above clustered column diagram revealed that with regard to**,** duration of intubation in group I majority 27 (90%) had 1-3 day and 3 (10%) had 4-6 days where as in group 11 all 30 (100%) 1-3 days.

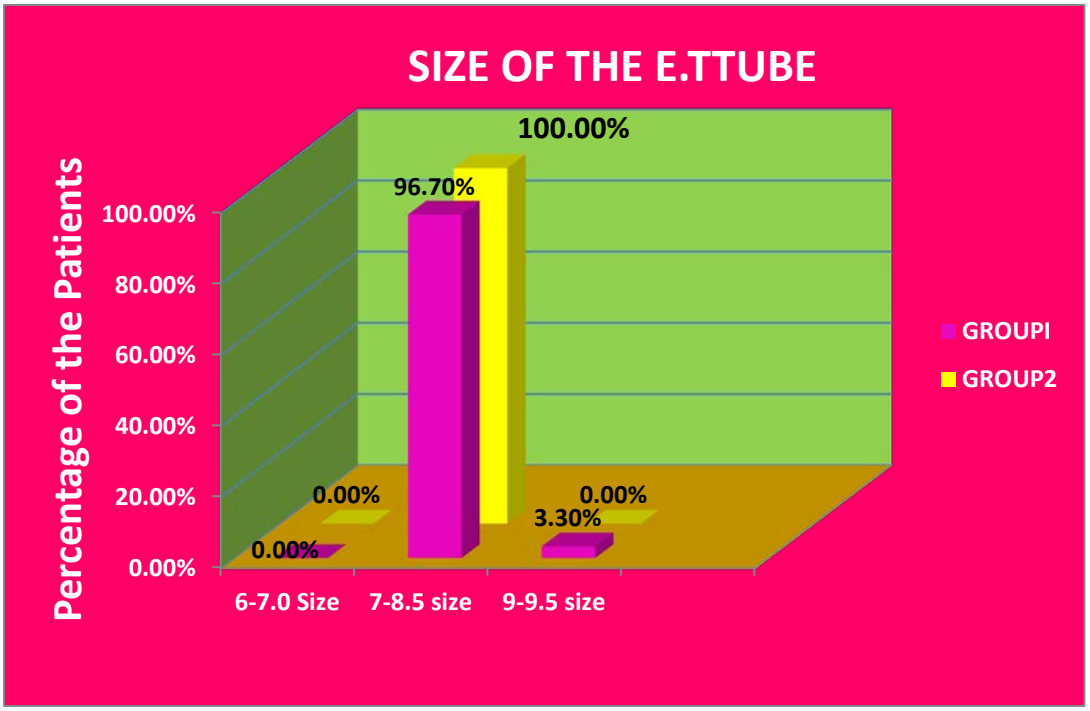


Figure – 9. Percentage distribution of size of the E.T.tube among intubated patients

The above 3D Column diagram revealed that the Size of the E,T tube in group 1 majority of intubated patients 29(9.7%) had 7-8.5 size E.T tube and 1 (3.3%) had 9-9.5 size E.T tube where as group 11 all 30(100%) had 7-8.5 size E.T tube.

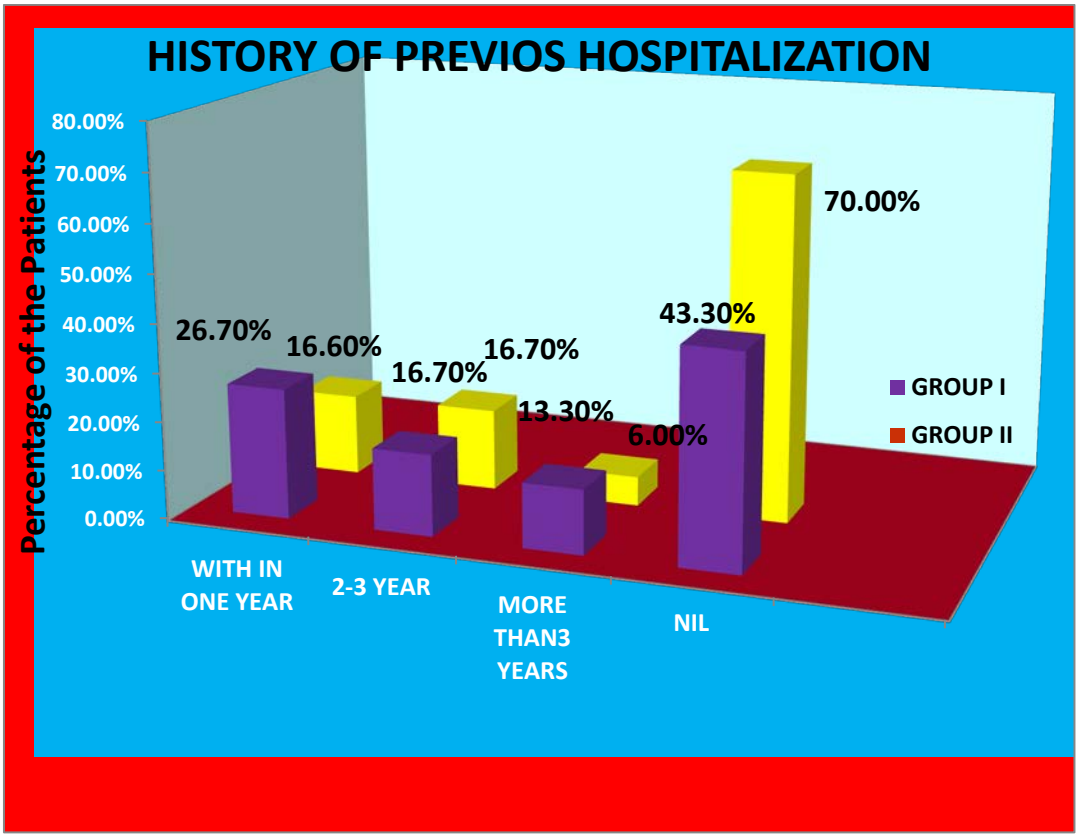


Figure – 10. Percentage distribution of history of previous hospitalization among intubated patients

The above 3D Column diagram revealed that according to the History of previous hospitalization in group 1 majority 13 (43.3%) had no history of previous hospitalization, 8(26.7%) had with in one year, 5(16.7 %) had within 2-3 years and 4(13.3 %) were with more than 3 years, where as in group 11 majority 21 (70%) had no history of previous hospitalization, 5(16.6%) had with in one year, 2(6.7 %) had within 2-3 years and 2(6.7%) had more than 3 years.

SECTION II

Description of level of airway clearance among intubated patients both in group I and group II

TABLE 3

Percentage distribution of Pretest level of airway clearance score both in group I and in group II among intubated patients

Level of airway clearance	Group				
	Group I		Group II		
	f	%	f	%	
Well cleared	0	0.0%	0	0.0%	$\chi 2=0.57$ P=0.75
Moderately cleared	6	20.0%	4	13.3%	DF=2 not significant
Minimally cleared	21	70.0%	22	73.4%	
Very minimally cleared	3	10.0%	4	13.3%	
Total	30	100%	30	100%	

` DF=Degrees of Freedom * significant P< 0.05 S = significant

The above table revealed the percentage pretest level of airway clearance score, in group – I patients, no one had well cleared airway clearance, 6 (20%) of them had moderately cleared level, 21(70%)of them had minimally cleared level and 3(10%) of them had very minimally cleared level.

In group –II patients, no one had well cleared airway clearance, 4(13.3%) of them had moderately cleared level, 22(73.4%) of them had minimally cleared level and 4(13.3%) of them had very minimally cleared level. Statistically there was nos significant difference between group-I and group-II and was assessed using chi square test.

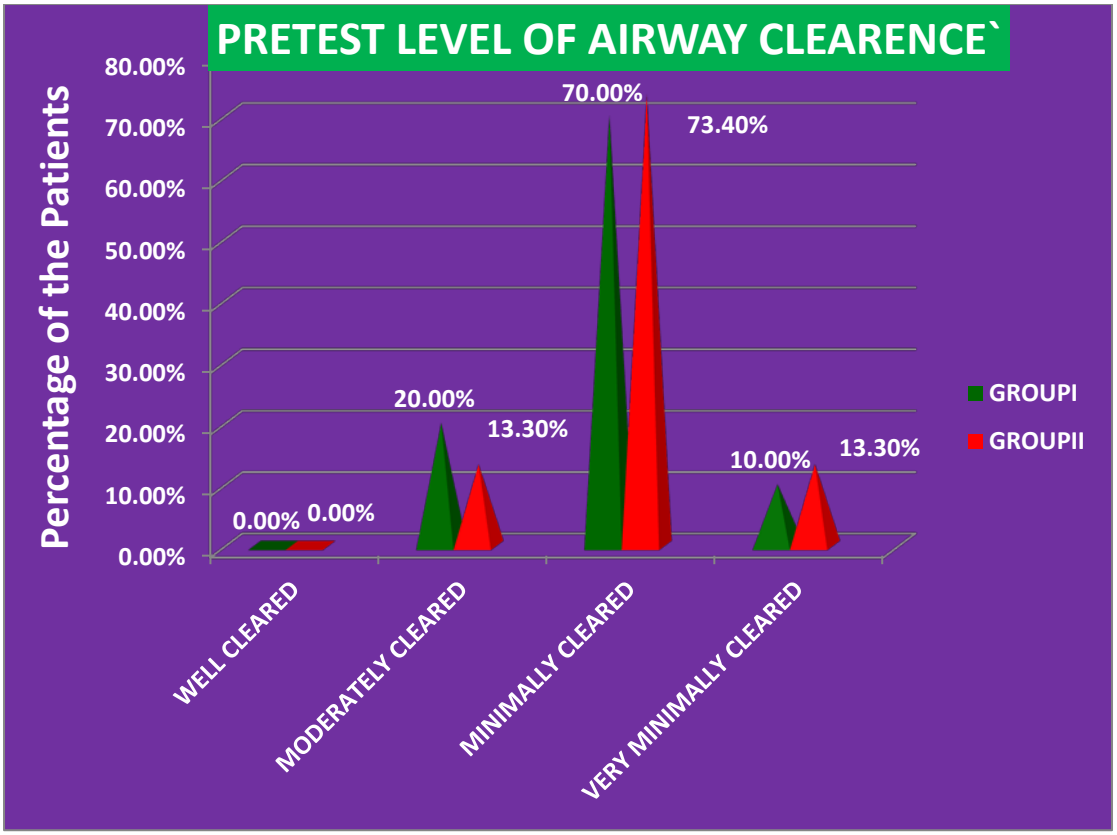


Figure – 11. Percentage distribution of pretest level of airway clearance in both group I and in groupI1 among intubated patients

The above clustered pyramid diagram revealed that pretest, in group –I patients, no one had well cleared airway clearance, 6 (20%) of them had moderately cleared level, 21(70%) of them had minimally cleared level and 3(10%) of them had very minimally cleared level.

In group –II patients, no one had well cleared airway clearance, 4(13.3%) of them had moderately cleared level, 22(73.4%) of them had minimally cleared level and 4 (13.3%) of them were very minimally cleared level. Statistically there was no significant difference between group 1 and group-11 and was assessed using chi square test.

TABLE 4

Pretest mean airway clearance score between group I and group II among intubated patients

	Group				Mean difference	Student independent t-test
	GroupI-I		Group-II			
	Mean	SD	Mean	SD		
Heart Rate	3.33	.74	3.07	.80	0.26	t=1.34 P=0.19 not significant
Oxygen Saturation	2.00	.00	2.07	.25	0.07	t=1.44 P=0.16 not significant
Respiratory Rate	2.37	.61	2.63	.81	0.26	t=1.44 P=0.16 not significant
Presence of Dyspnoea	2.33	.76	2.37	.72	0.04	t=0.17 P=0.86 not significant
Auscultation of lung fields	2.43	.68	2.67	.66	0.24	t=1.34 P=0.19 not significant
Overall	12.20	1.56	13.07	2.21	0.87	t=1.75 P=0.09 not significant

The above table revealed the pretest mean airway clearance score between group-I and group-II among intubated patients.

In pretest Group I heart rate mean score was 3.07 with SD 0.74, oxygen saturation mean score was 2.00 with SD 0.0, Respiratory rate mean score was 2.37 with SD 0.61, presence of dysphonea mean score was 2.33 with SD 0.76 and auscultation of lung fields mean score was 2.43 with SD 0.68.

In pretest Group II heart rate mean score was 3.33 with SD 0.80, oxygen saturation mean score was 2.07 with SD 0.25, Respiratory rate mean score was 2.63 with SD 0.81, presence of dysphonea mean score was 2.37 with SD 0.72 and auscultation of lung fields mean score was 2.67 with SD 0.66.

TABLE 5

Pretest mean airway clearance difference score between both group I and group II

	No. of patients	Score Mean ± SD	Mean Difference	Student's independent t-test
Experiment-1	30	12.20± 1.56	0.87	t=1.75 P=0.09 DF = 58 not significant
Experiment-II	30	13.07± 2.21		

DF=Degrees of freedom p>0.05 not significant

The above table revealed Pretest mean airway clearance difference score between both group I and group II. In pretest, group-I had mean score 12.20 and group-II had mean score 13.07, so the difference mean score was 0.87. The difference mean score between group-I and group-II was small and it was not statistically significant which was analyzed using students independent t-test.

SECTION III

Effectiveness of endotracheal suctioning in group I and group II on airway clearance among intubated patients

TABLE 6

Percentage distribution of Post test level of airway clearance in both group I and in group-II among the intubated patients

Level of airway clearance	Group				$\chi 2$
	Group-I		Group-II		
	n	f	n	f	
Well cleared	0	0.0%	4	13.3%	**$\chi 2$=27.15P=0.001*** DF=2 significant**
Moderately cleared	12	40.0%	26	86.7%	
Minimally cleared	18	60.0%	0	0.0%	
Very minimally cleared	0	0.0%	0	0.0%	
Total	30	100%	30	100%	

` DF=Degrees of Freedom * significant P< 0.05 S = significant

The above table revealed the Percentage distribution of post test level of airway clearance score, in group–I patients, no one had well cleared airway clearance, 12 (40%) of them had moderately cleared level, 18(70%) of them had minimally cleared level and no one had very minimally cleared level.

In group–II patients, 4(13.3%) had well cleared airway clearance, 26(86.7%) of them had moderately cleared level and no one had minimally cleared level and very minimally cleared level. Statistically there was no significant difference between group I and group-II and was assessed using chi square test.

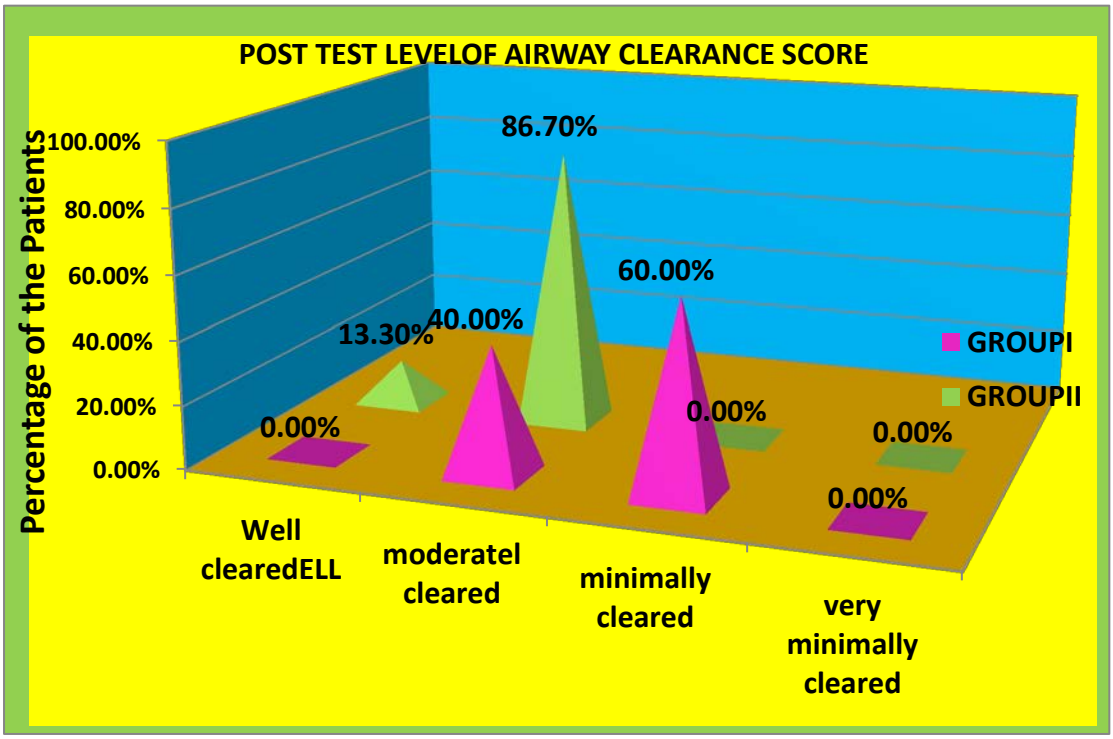


Figure – 12. Percentage distribution of posttest level of airway clearance score among the intubated patients in both group-I and group-II

The above 3D Pyramid diagram revealed the Percentage distribution of post test level of airway clearance score, in group –I patients, no one had well cleared airway clearance,12 (40%) of them had moderately cleared level, 18 (70%)of them had minimally cleared level and no one had very minimally cleared level.

In group –II patients, 4(13.3%) had well cleared airway clearance, 26(86.7%) of them had moderately cleared level and no one had minimally cleared level and very minimally cleared level.

TABLE 7

Post test mean airway clearance score between group I and group II

	Group				Mean difference	Student independent t-test
	Group-I		Group-II			
	Mean	SD	Mean	SD		
Heart Rate	2.63	.76	1.70	.47	0.93	t=5.70 P=0.001*** significant
Oxygen Saturation	1.87	.35	1.03	.18	0.84	t=11.67 P=0.001*** significant
Respiratory Rate	2.27	.64	1.60	.56	0.67	t=4.28 P=0.001*** significant
Presence of Dyspnoea	1.90	.76	1.43	.50	0.47	t=2.80 P=0.001*** significant
Auscultation of lung fields	2.33	.66	1.43	.57	0.90	t=5.65 P=0.001*** significant
Overall	11.03	1.73	7.23	1.38	3.80	t=9.39 P=0.001*** significant

*** significant P< 0.001

The above table showed the post test mean airway clearance score between group-I and group -II.

In posttest Group I heart rate mean score was 2.63 with SD 0.76, oxygen saturation mean score was 1.87 with SD 0.35, Respiratory rate mean score was 2.27 with SD 0.64, presence of dysphonea mean score was 1.90 with SD 0.76,and auscultation of lung fields mean score was 2.33 with SD 0.66.

In posttest Group II heart rate mean score was1.70 with SD 0.47, oxygen saturation mean score was 1.03 with SD 0.18, Respiratory rate mean score was1.60 with SD 0.56, presence of dysphonea mean score was 1.43 with SD 0.50 and auscultation of lung fields mean score was 1.43 with SD 0.57.

TABLE 8

Posttest mean airway clearance difference score between both group I and group II

	No. of patients	score Mean ± SD	Mean Difference	Student's independent t-test
Experiment-1	30	11.03± 1.73	3.80	t=9.39 P=0.001*** DF =58 significant
Experiment-II	30	7.23± 1.38		

DF= Degrees of Freedom *** P<0.001 significant

The above table revealed Post test mean airway clearance difference score between both group1 and group-II.

In posttest, group -I had mean score 11.03 and group-II had mean score 7.23, so the difference mean score was 3.80. The difference mean score between group -I and group -II was large and it was statistically significant which was analyzed using students independent t-test.

SECTION IV

Comparison of effectiveness between endotracheal suctioning without normal saline in group I and with normal in group II on airway clearance among intubated patients

TABLE 9

Comparison of pre test and post test airway clearance mean score between group-I and group- II

		No. of patients	score Mean ± SD	Mean Difference	Student's paired t-test
Pretest	GROUP I	30	12.20± 1.56	0.87	t=1.75 P=0.09 DF =29 Not significant
	GROUP II	30	13.07± 2.21		
Posttest	GROUP I	30	11.03± 1.73	3.80	**t=9.39 P=0.001*** DF =29 significant**
	GROUP II	30	7.23± 1.38		

Fig13P>0.05 not significant *** significant P< 0.05

The above table revealed the **c**omparison of pre test and post test airway clearance mean score between group -I and group -II

In pretest, group -I the airway clearance mean score was 12.20 where as in post test it was 11.03 and the mean airway clearance score difference was 0.87 . It was small and was not statistically significant and was as analyzed using students paired t-test.

In pre test group II airway clearance mean score was 13.07 where as in post test it was 7.23 and the mean airway clearance difference was 3.80. It was large and statistically significant and it was analyzed using students paired t-test.

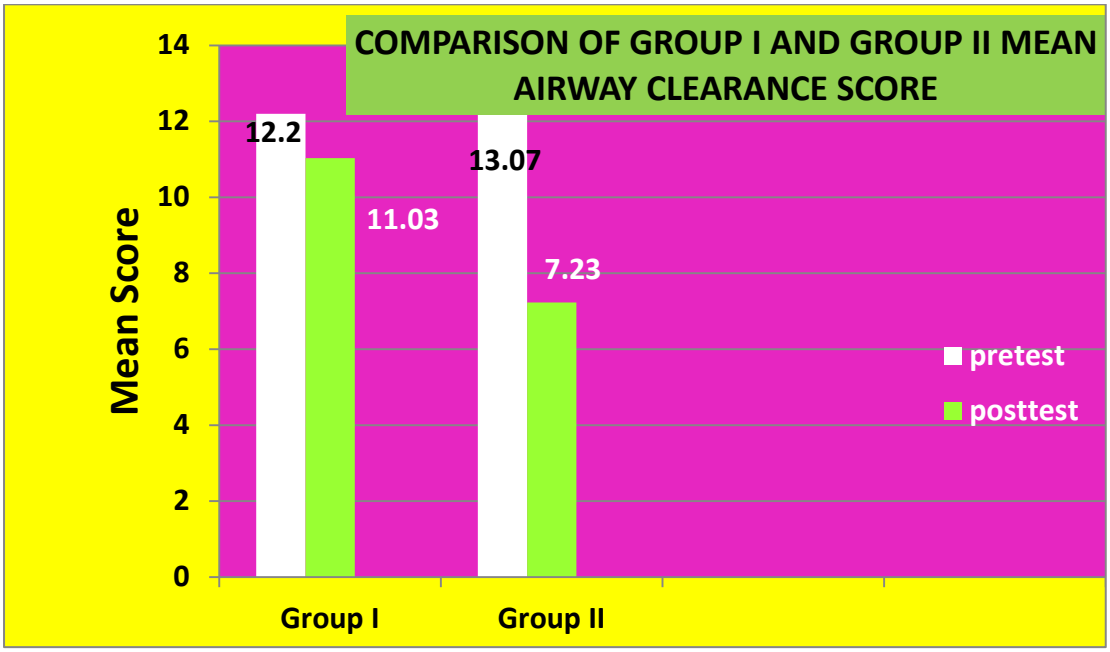


Figure - 13. Comparison of pre test and post test mean airway clearance score between group -I and group – II

The above clustered column diagram revealed that in pretest, group -I the airway clearance mean score was 12.20 where as in post test it was 11.03. In pre test group II airway clearance mean score was 13.07 where as in post test it was 7.23.

TABLE 10

Pretest and post test level of airway clearance score between group -I and group –II

	Level of airway clearance	Group				Extended McNemar's test
		Pretest		Posttest		
		f	%	f	%	
GROUP I	Well cleared	0	0.0%	0	0.0%	$\chi 2$=7.50 P=0.02* DF=2 significant
	Moderately cleared	6	20.0%	12	40.0%	
	Minimally cleared	21	70.0%	18	60.0%	
	Very minimally cleared	3	10.0%	0	0.0%	
	Total	30	100%	30	100%	
GROUPII	Well cleared	0	0.0%	4	13.3%	$\chi 2$=26.28 P=0.001*** DF=3 Significant
	Moderately cleared	4	13.3%	26	86.7%	
	Minimally cleared	22	73.4%	0	0.0%	
	Very minimally cleared	4	13.3%	0	0.0%	
	Total	30	100%	30	100%	

DF= Degrees of Freedom * significant P< 0.05 S= significant

The above table revealed the comparison of pretest and posttest level of airway clearance score between group-I and group-II.

Considering pretest, in group–I no one had well cleared airway clearance, 20% of them had moderately cleared level, 21% of them had minimally cleared level, and 10% of them had very minimally cleared level. Where as post test no one had well cleared airway clearance, 40% of them had moderately cleared level, 60% of them had minimally cleared level, no one had very minimally cleared level.

In pre test In group–II, no one had well cleared airway clearance, 13.3% of them had moderately cleared level, 73.3% of them had minimally cleared level and 13.3% of them had very minimally cleared level. Where as post test in group–II patients, 13.3% of them had well cleared airway clearance and all the other 86.7% of them are had moderately cleared level, and no one of them had minimally cleared level and very minimally cleared level. It was assessed using extended McNemars-test. According to extended McNemars-test there is a highly significant difference between pretest and post test level of airway clearance.

SECTION IV

Comparison of effectiveness between endotracheal suctioning without normal saline in group I and with normal in II on airway clearance among intubated patients

TABLE 11

Comparison of mean airway clearance score between pretest and posttest in group I and group II

		No. of patients	score Mean ± SD	Mean Difference	Student's paired t-test
Group-I	Pretest	30	12.20± 1.56	1.17	**t=4.59 P=0.001*** DF =29 significant**
	Posttest	30	11.03± 1.73		
Group-II	Pretest	30	13.07± 2.21	5.83	**t=13.85 P=0.001*** DF =29 significant**
	Posttest	30	7.23± 1.38		

DF= Degrees of Freedom ** significant<0.01 *** significant at P≤0.001

Table no 11 showed the mean airway clearance score between pretest and posttest in group I and group II.

In pretest group I had 12.20 mean airway clearance score where as in posttest they had 11.03 mean airway clearance score so the difference was 1.17 score The difference between group-I and group-II score was large and statistically significant. Differences between pretest and posttest score was analyzed using students paired t-test.

Considering group-II patients, in pretest they had 13.07 mean airway clearance score where as in posttest they had 7.23 mean airway clearance score, so the difference was 5.83 score The difference between group I and group II was large and is statistically significant. Differences between pretest and posttest score was analyzed using students paired t-test.

TABLE 12

Percentage of airway clearance (improvement) score among intubated patients between group I and group II

		Max score	*Airway clearance score* Mean ± SD	Mean Difference score with 95% Confidence interval	Percentage of airway clearance reduction score with 95% Confidence interval
Experiment-I	Pretest	20	12.20± 1.56	1.17(0.65 -1.69)	5.9%(3.3% –8.4%)
	Posttest	20	11.03± 1.73		
Experiment-II	Pretest	20	13.07± 2.21	5.83(4.97 -6.69)	29.2%(24.8% – 33.4%)
	Posttest	20	7.23± 1.38		

The above table shows the percentage of airway clearance (improvement) score among intubated patients between group I and group II.

On an average, group-I patients had mean difference with 95% confidence interval was 1.17 and percentage of airway clearance (improvement) score with 95% Confidence interval was 5.9% (3.3%-8.4%), whereas group II patients had mean difference with 95%confidence interval was 5.83 and percentage of airway clearance (improvement) score with 95% Confidence interval was 29.2% (24.8%-33.4%) .

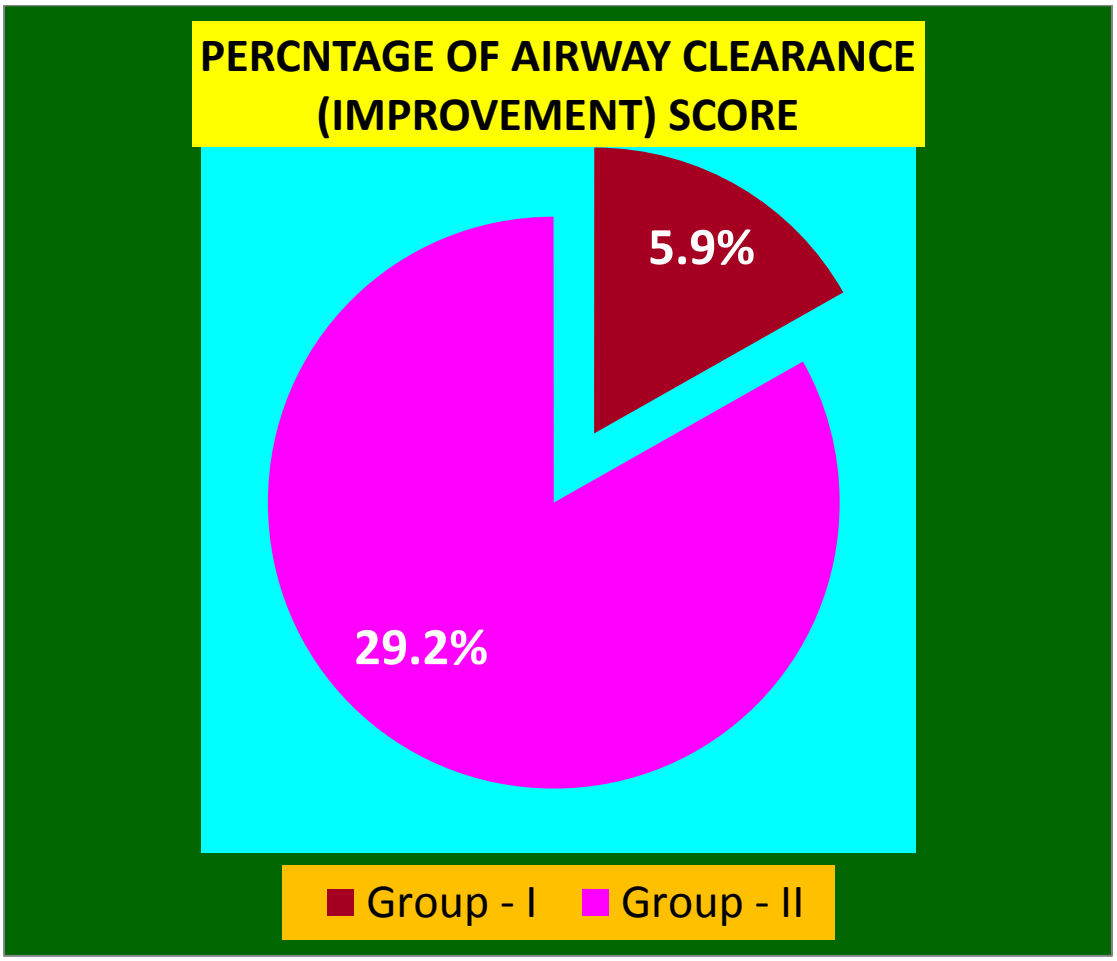


Figure – 13. Comparison of percentage of Air way clearance (improevement) score between group -I and group – II

The above pie diagram reveals on an average, experiment group I patients had 5.9% of airway clearance (improvement) score, whereas group II group patients had 29.2% of airway clearance (improvement) score.

SECTION V

Association between level of airway clearances among intubated patients and their selected socio - demographic variables.

TABLE 13

Association between posttest level of airway clearance score and patients demographic variables in group-I

Demographic variables		Posttest level of airway clearance				Total	Chi square test
		Moderately cleared		Minimally cleared			
		n	%	n	%		
Age	15 -30 years	6	50.0%	6	50.0%	12	$\chi 2=0.83$
	31 -45 years	2	33.3%	4	66.7%	6	P=0.84DF=3
	46 -60 years	2	33.3%	4	66.7%	6	NS
	61 -75 years	2	33.3%	4	66.7%	6	
Sex	Male	6	31.5%	13	68.5%	19	$\chi 2=1.53$
	Female	6	54.5%	5	45.5%	11	P=0.21DF=1 NS
Occupation	Unemployed	7	41.2%	10	58.8%	17	$\chi 2=3.67$
	Farmer	3	60.0%	2	40.0%	5	P=0.45 DF=4
	Private	0	0.0%	2	100.0%	2	NS
	Government	2	50.0%	2	50.0%	4	
	Industrial	0	0.0%	2	100.0%	2	
Area of residence	Town	6	50.0%	6	50.0%	12	$\chi 2=1.42$ P=0.69 DF=3
	Village	4	28.6%	10	71.4%	14	NS
History of smoking	Non smoking	9	42.9%	12	57.1%	21	$\chi 2=6.49$ P=0.16 DF=4
	1-5 years	0	0.0%	2	100.0%	2	NS
	6-10 years	1	50.0%	1	50.0%	2	
	11-15 years	2	100.0%	0	0.0%	2	
	>15 years	0	0.0%	3	100.0%	3	
Duration of admission in hospital	1-3 days	7	36.8%	12	63.2%	19	$\chi 2=1.02$ P=0.79 DF=3 NS
	4 -6 days	2	40.0%	3	60.0%	5	
	7 -9 days	2	66.7%	1	33.3%	3	
	> 10 days	1	33.3%	2	66.7%	3	
Diagnosis	Medical	11	37.9%	18	62.1%	29	$\chi 2=1.55$
	Surgical	1	100.0%	0	0.0%	1	P=0.21 DF=1 NS

Duration of intubation	1-3 days	10	37.0%	17	63.0%	27	$\chi 2=0.98$ P=0.32 DF=1 NS
	4-6 days	2	66.7%	1	33.3%	3	
Size of the E.T TUBE	7- 8.5 size	12	41.4%	17	58.6%	29	$\chi 2=0.69$ P=0.40 DF=1 NS
	9- 9.5 size	0	0.0%	1	100.0%	1	
History of previous hospitalization	Within one year	4	50.0%	4	50.0%	8	$\chi 2=0.72$ P=0.86 DF=3 NS
	2- 3 Year	2	40.0%	3	60.0%	5	
	More than 3 years	1	25.0%	3	75.0%	4	
	Nil	5	38.5%	8	61.5%	13	

The above reveals that the association between post test level of airway clearance score and patients demographic variables in group-I. None of the variables are significantly associated with pretest airway clearance score. Statistically significance was calculated using chi square test.

TABLE 14

Association between posttest level of airway clearance score and patients demographic variables in group-II

Demographic variables		Posttest level of airway clearance				Total	Chi square test
		Well cleared		Moderately cleared			
		n	%	n	%		
Age	15 -30 years	4	40.0%	6	60.0%	10	**$\chi 2=9.23$ P=0.05*DF=3S**
	31 -45 years	0	0.0%	11	100.0%	11	
	46 -60 years	0	0.0%	7	100.0%	7	
	61 -75 years	0	0.0%	2	100.0%	2	
Sex	Male	1	4.3%	22	95.7%	23	**$\chi 2=6.88$ P=0.01** DF=1 S**
	Female	3	42.9%	4	57.1%	7	
Occupation	Unemployed	3	25.0%	9	75.0%	12	$\chi 2=3.60$ P=0.42 DF=4 NS
	Farmer	0	0.0%	7	100.0%	7	
	Private	0	0.0%	3	100.0%	3	
	Government	0	0.0%	3	100.0%	3	
	Industrial	1	20.0%	4	80.0%	5	
Area of residence	Town	1	7.7%	12	92.3%	13	$\chi 2=2.04$ P=0.56 DF=3 NS
	Village	3	23.1%	10	76.9%	13	
History of smoking	Non smoking	3	15.0%	17	85.0%	20	$\chi 2=2.16$ P=0.70 DF=4 NS
	1-5 years	1	33.3%	2	66.7%	3	
	6-10 years	0	0.0%	2	100.0%	2	
	11-15 years	0	0.0%	3	100.0%	3	
	>15 years	0	0.0%	2	100.0%	2	
Duration of admission in hospital	1-3 days	4	33.3%	8	66.7%	12	**$\chi 2=9.32$ P=0.05* DF=3 S**
	4 -6 days	0	0.0%	7	100.0%	8	
	7 -9 days	0	0.0%	4	100.0%	6	
	> 10 days	0	0.0%	4	100.0%	4	
Diagnosis	Medical	4	13.3%	26	86.7%	30	$\chi 2=0.00$ P=1.00 DF=1 NS
Duration of intubation	1-3 days	4	13.3%	26	86.7%	30	$\chi 2=0.00$ P=1.00 DF=1 NS
Size of the E.T TUBE	7- 8.5 size	4	13.3%	26	86.7%	30	$\chi 2=0.00$ P=1.00 DF=1 NS
History of previous hospitalization	Within one year	1	20.0%	4	80.0%	5	$\chi 2=0.82$ P=0.84 DF=3 NS
	2- 3 Year	0	0.0%	2	100.0%	2	
	More than 3 years	0	0.0%	2	100.0%	2	
	Nil	3	14.3%	18	85.7%	21	

The above table shows that the association between posttest level of airway clearance score and patients demographic variables in group -II. Younger, female and less duration of admission in hospital patients are having more reduced air clearance score than others. Statistically significance was calculated using chi square test.

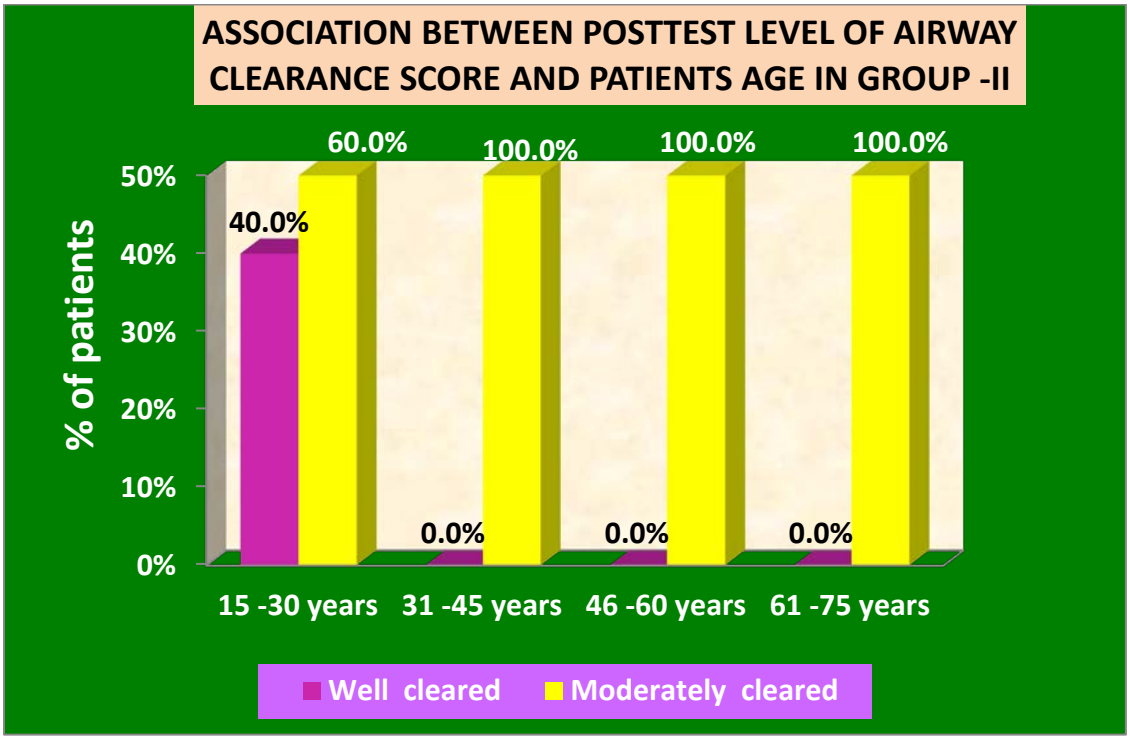


Figure – 15. Association between post test level of airway clearance score and patients age in group-II

The above three D clustered column depicts the association between post test level of airway clearance score and patients age in group–II.

In group-II the patients with the age group between 15-30 only 40% were having well cleared airway and 60% were having moderately cleared airway, in age group between 31-45, 46-60, and 61-75 all 100% of them were having moderately cleared airway.

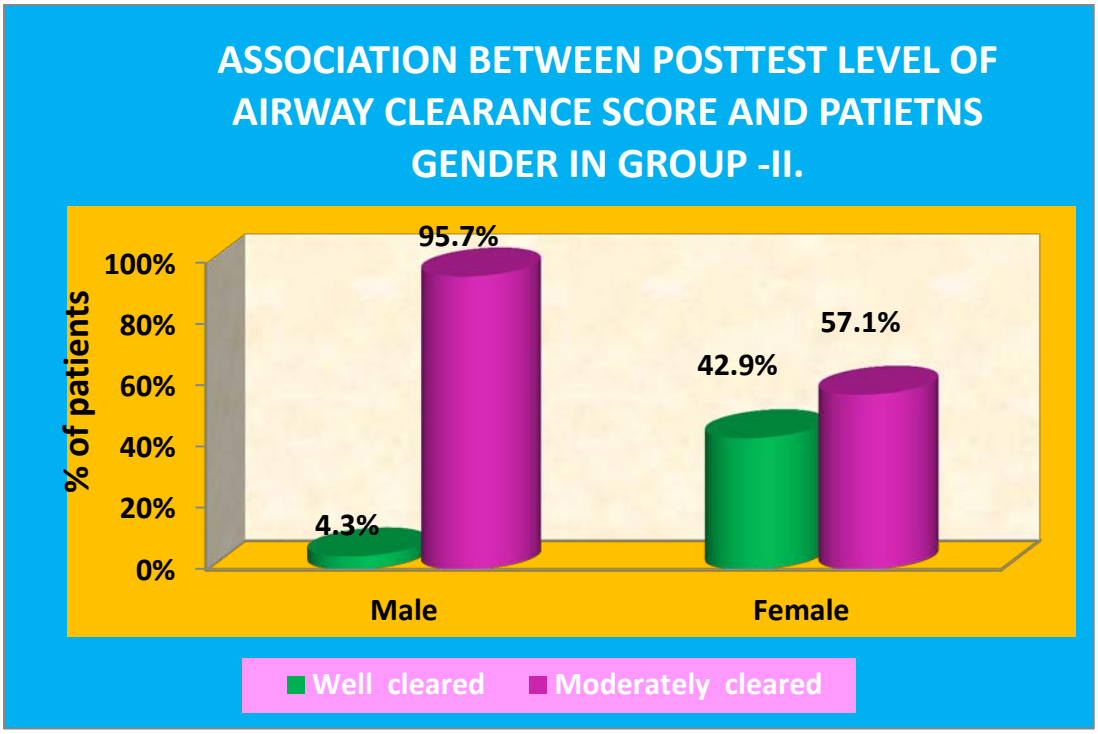
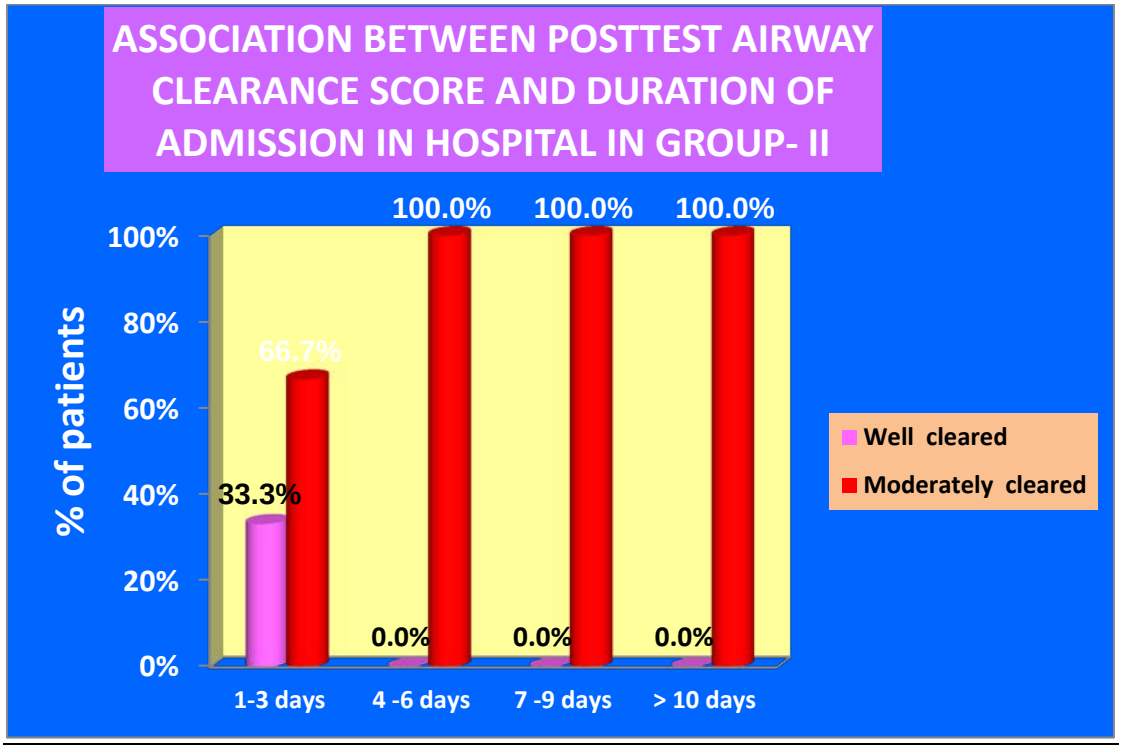


Figure-16. Association between posttest level of airway clearance score and patients gender in group-II

The above clustered cylinder diagram depicts the association between post test level of airway clearance score and patients gender in group-II. Only 4.3% of the male patients were having well cleared airway and 95.7% of the males were having moderately cleared airway and 42.9% of the female patients were having well cleared airway and 57.1% of the female patients were having moderately cleared airway.



Figure—17. Association between post test airway clearance score and duration of admission in hospital in group - II

The above clustered cylinder diagram depicts the association between post test level of airway clearance score and patients duration of admission in hospital in group –II. 33.3% of the patients with 1-3 days of duration of admission were having well cleared airway and 66.7% of them were having moderately cleared airway, and in patients with 4-6 days, 7-9 days and more than 10 days of duration of admission all 100% of the patients were having moderately cleared airway.

Discussion

CHAPTER - V

DISCUSSION

This chapter deals with detailed discussion of the data and results interpreted from the statistical, inferential analysis. The present study was focused to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline, on airway clearance among intubated patients admitted in Intensive Medical Care Unit at Government Rajaji Hospital, Madurai. The endotracheal suctioning is a method of clearing the secretion from the airway and is performed through an artificial airway (endotracheal tube) either nasotrachealy or orotrachealy. It promotes optimal exchange of oxygen and carbon dioxide into and out of lungs and to prevent pneumonia resulting from the collection of the secretion and hypoxia related problems due to the blockage of tubes. In this study, Researcher adopted a Quantitative approach, True experimental - pre-test post test design, 60 subjects were selected by Non probability (consecutive sampling) technique and assigned 30 subjects into groups I and 30 subjects into group II. Pre test was done and an airway clearance was done by suctioning without normal saline for group I and with normal saline to group II every second hourly and on demand basis. 10 minutes after the last endotracheal suctioning (approximately between 7pm to 7.30 pm) post test was done with the same observational check list.

Discussion of socio demographic variables

Regarding Age, in group I majority 12 (40.0%), were between 15 - 30 years, 6 (20.0%) were between 31-45 years, 6 (20.0%) were between 46-60 years and 6 (20.0%) were between 61 - 75 yrs where as in group II the majority 11 (36.7.0%) were between 31-45 years, 10 (33.3%), were more between 15 to 30 years, 7 (23.3%) were between 46-60 years and 2 (6.7%) were between 61 -75 yrs.

With regard to Sex**,** in group I majority 19(63.3%) were males and remaining 11(36.7%) were females where as in group II only 23(76.7%) were males and remaining 7(23.3%) were females.

By seeing Occupation in group I majority 17(56.7%) were Unemployed, 5 (16.6%) were farmers, 2(6.7%) were private employees, 4(13.37%) were government employees, 2(6.7%) were industrial workers where as in group II majority 12 (40%) were Unemployed, 7(23.36%) were farmers, 3(10.0%) were private employees, 3 (10%) were government employees, 5(16.7%) were industrial workers.

According to Area of residence, in group I majority 16 (53,3%) were from village, 14(46.7%) were from town where as in group II 15(50%) were from village,15(50%) were from town.

While viewing history of Smoking in group I majority 21(70%) were non smokers, 3(10%) were smoking for more than 15 years, 2(6.7%) were smoking for 1-5 years, 2(6.7%) were smoking for 6-10 years and 2(6.7%) were smoking for 11-15 years where as in group II majority 20(66.6%) were non smokers, 3(10%) were smoking for 1-5 years, 3(10%) were smoking for 11-15 years, 2(6.7%) were smoking for more than 15 years.

While seeing Duration of admission in hospital in group I majority 19(63.3%) were having the history of 1-3 days of hospitalization, 5(16.7%) were having 4-6 days of hospitalization 3 (10%) were having 7-9 days of hospitalization and 3 (10%) were having more than 10 days of hospitalization where as in group II majority 12(40%) were from 1-3 days of hospitalization, 8(26.7%) were having history of 4-6 days of hospitalization 6 (20%) were having 7-9 days of hospitalization and 4(13.3%) were having more than 10 days of hospitalization.

Discussion of clinical variables

Regarding Diagnosis, in group 1 majority 29(96.7.0%), had medical problems and 1(3.3%) had surgical problems where as in group II all 30(100%), had medical problems.

With regard to**,** duration of intubation in group I majority 27 (90%) were from 1-3 days and 3 (10%) were from 4-6 days where as in group 11 all 30 (100%) werefrom 1-3 days

By seeing Size of the E,T tube in group 1 majority of intubated patients 29(9.7%) had 7-8.5 size E.T tube and 1 (3.3%) had 9-9.5 size E.T tube where as group 11 all 30(100%) had 7-8.5 size E.T tube .

According to the History of previous hospitalization in group 1 majority 13 (43.3%) had no history of previous hospitalization, 8(26.7%) had with in one year, 5(16.7 %) had within 2-3 years and 4(13.3 %) were with more than 3 years, where as in group 11 majority 21 (70%) had no history of previous hospitalization, 5(16.6%) had with in one year, 2(6.7 %) had within 2-3 years and 2(6.7%) had more than 3 years .

- **The first objective of the study was to assess the level of airway clearance among the intubated patients in both group I and group II at Government Rajaji hospital, Madurai.**

Pretest level of airway clearance score, in group–I patients, no one had well cleared airway clearance, 6(20%) of them had moderately cleared level, 21(70%) of them had minimally cleared level and 3(10%) of them had very minimally cleared level. Where as in group–II patients, no one had well cleared airway clearance, 4(13.3%) of them had moderately cleared level, 22(73.4%) of them had minimally cleared level and 4(13.3%) of them had very minimally cleared level. Statistically

there was no significant difference between group 1 and group-11 and was assessed using chi square test.

The study was supported by Ayhan and colleagues (2013), analysed only 7 articles, focusing the following issues: impact on sputum amount, impact on oxygenation, on haemodynamics, on pulmonary infection and NSI distribution in the lungs. They resolved that there is sufficient evidence to conclude that NSI before endotracheal suctioning, which is used to soften an easily remove secretions, significantly decreases the patient's oxygenation. However, the impact of NSI on the sputum amount, haemodynamics and ventilator-associated pneumonia incidence remains controversial. Regarding the use of NSI both authors found similar results. Most professionals generally use the NSI before endotracheal suctioning. The amount of normal saline used is most frequently less than 5 ml. When asking for the reason to use NSI, most health carers responded to liquefy the secretions.

The second objective of the study was to evaluate the effectiveness of endotracheal suctioning without normal saline in group I and with normal saline in Group II on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

Percentage distribution of post test level of airway clearance score, in group –I patients, no one had well cleared airway clearance, 12 (40%) of them had moderately cleared level, 18 (70%) of them had minimally cleared level and no one had very minimally cleared level.

In group –II patients, 4(13.3%) had well cleared airway clearance, 26(86.7%) of them had moderately cleared level and no one had minimally cleared level and very minimally cleared level. Statistically there was significant difference in the level of airway clearance between group I and group-II and was assessed using chi square test.

The study was supported by Jennifer Paratz **(2015)** conducted A review of article to investigate the efficacy and safety of the technique of instillation of normal saline prior to suction of airways in intubated patients at research Centre, Department of Intensive Care Medicine, University of Queensland. Databases searched included: MEDLINE, CINAHL, EMBASE, Citation tracking of relevant primary and review articles. All randomised controlled trials, crossover trials, quasi- and full systematic reviews were screened. From 65 articles screened, 17 articles (two quasi-systematic reviews and 15 empirical studies) met the eligibility criteria and were included for data extraction. The outcomes in the reviewed studies included oxygenation, lung mechanics, sputum yield, dyspnoea, tube patency and ventilator-associated pneumonia. Effect sizes and 95% confidence intervals were calculated. Studies were mainly of low methodological quality due to factors such as lack of assessor blinding and within-group-only statistics. Overall, there was a positive effect favouring the use of saline to increase sputum yield (d=0.50, 95% confidence interval 0.10 to 0.90). Due to heterogeneity of methodology, it was not possible to perform meta-analyses on haemodynamics, oxygenation, tube patency and ventilator-associated pneumonia.

Hence the Hypothesis H_1 There is a significant difference between groupI and groupII after endotracheal suctioning on airway clearance among intubated patients at Government Rajaji hospital, Madurai was accepted.

The third objective of the study was to compare the effectiveness between endotracheal suctioning in Group I and in Group II among intubated patients at Government Rajaji hospital, Madurai.

Comparison of pre test and post test airway clearance mean score between group -I and group -II revealed that in pretest, group -I the airway clearance mean score was 12.20 where as in post test it was 11.03 and the mean airway clearance score difference was 0.87. It was small and was not statistically significant and was as analyzed using students paired t-test.

In pre test group II airway clearance mean score was 13.07 where as in post test it was 7.23 and the mean airway clearance difference was 3.80. It was large and statistically significant and it was analyzed using students paired t-test.

In pretest group I had 12.20 mean airway clearance score where as in posttest they had 11.03 mean airway clearance score so the difference was 1.17 score The difference between Group group-I and Group group-II score was large and statistically significant. Differences between pretest and posttest score was analyzed using students paired t-test.

Considering group-II patients, in pretest they had 13.07 mean airway clearance score where as in posttest they had 7.23 mean airway clearance score, so the difference was 5.83 score The difference between group I and group II was large and is statistically significant. Differences between pretest and posttest score was analyzed using students paired t-test.

On an average, group-I group patients had mean difference with 95%confidence interval was 1.17 and percentage of airway clearance reduction score with 95% Confidence interval was 5.9% (3.3%-8.4%) where as in group II patients

had mean difference with 95%confidence interval was 5.83 and percentage of airway clearance reduction score with 95% Confidence interval was 29.2% (24.8%-33.4%).

Hence the Hypothesis H_2: There is a significant difference between the pretest and post test score of airway clearance in both group I and in group II after endotracheal suctioning was accepted.

The fourth objective of the study was to associate the level of airway clearance among Group I and Group II intubated patients at Government Rajaji hospital, Madurai with their selected socio demographic and clinical variable

There was significant association between post test level of airway clearance score and patients demographic and clinical variables in Experiment-II group. Younger, females and less duration of admission in hospital patients are having more reduced air clearance score than others. Statistically significance was calculated using chi square test.

Thus the Hypothesis H_3 :There is a significant association between the level of airway clearance among intubated patients at Government Rajaji hospital, Madurai with their selected socio demographic and clinical variables was accepted.

Summary, Conclusion, Implications & Recommendations

CHAPTER – VI

SUMMARY CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

This chapter narrates the summary of the study and the conclusion drawn. It also describes the implications for different areas like Nursing education, Nursing administration, Nursing practice and Nursing research. It provides the recommendations based on the study.

6.1 Summary

The present study was conducted to evaluate the effectiveness of the endotracheal suctioning with normal saline versus without normalsaline on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

The following hypotheses were tested at 0.05 level of significance

H_1 There is a significant difference between the pretest and post test scores between Group I and Group II after endotracheal suctioning on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

H_2-There is a significant difference between post test scores in Group I and Group II after endotracheal suctioning on airway clearance among intubated patients at Government Rajaji hospital, Madurai.

H_3 There is a significant association between the level of airway clearance among intubated patients at Government Rajaji hospital, Madurai with their selected socio demographic data and clinical variables.

The conceptual frame work was based on modified orem's self care theory (1991) wholly compensatory which comprises of self care, self care agency, self care demands, deficit, Nursing care Agency.

The tool used in this study consists of Socio demographic variables – age, sex, occupation, area of residence, history of smoking, and duration of admission and Clinical Variables –diagnosis, duration of intubation, size of the E.T.T and structured observational check list for evaluating airway clearance .It has five grading systems with four characteristics in each.

Content validity was obtained from five experts in the field of Medicine and Medical surgical nursing. On the 1st day, after data collection with structured observational check list for airway clearance , the level of airway clearance was assessed and endotracheal suctioning without normal saline was given to the group1 and endotracheal suctioning with normal saline was given to the 11 every second hourly and also on demand basis from 7am to 7pm. Post test was done 10 minutes after the last suctioning at 7 pm with the self structured observational check list, data were analyzed using descriptive and inferential statistics.

6.2 Major findings of the study

Regarding Age, in group I majority 12(40.0%), were between 15 - 30 years, 6 (20.0%) were between 31-45 years, 6(20.0%) were between 46-60 years and 6 (20.0%) were between 61 - 75 yrs where as in group II the majority 11(36.7.0%) were between 31-45 years, 10(33.3%), were more between 15 to 30 years, 7(23.3%) were between 46-60 years and 2(6.7%) were between 61 -75 yrs.

With regard to Sex**,** in group I majority 19(63.3%) were males and remaining 11(36.7%) were females where as in group II only 23(76.7%) were males and remaining 7(23.3%) were females.

By seeing Occupation in group I majority 17(56.7%) were Unemployed, 5(16.6%) were farmers, 2(6.7%) were private employees, 4(13.37%) were government employees, 2(6.7%) were industrial workers where as in group II

majority 12(40%) were Unemployed, 7(23.36%) were farmers, 3(10.0 %) were private employees, 3(10%) were government employees, 5(16.7%) were industrial workers.

According to Area of residence, in group I majority 16(53,3%) were from village, 14(46.7%) were from town where as in group II 15(50%) were from village,15(50%) were from town.

While viewing history of Smoking in group I majority 21(70%) were non smokers, 3 (10%) were smoking for more than 15 years, 2 (6.7%) were smoking for 1-5 years, 2 (6.7%) were smoking for 6-10 years and 2 (6.7%) were smoking for 11-15 years where as in group II majority 20(66.6%) were non smokers, 3 (10%) were smoking for 1-5 years, 3 (10%) were smoking for 11-15 years, 2 (6.7%) were smoking for more than 15 years.

While seeing Duration of admission in hospital in group I majority 19 (63.3%) were having the history of 1-3 days of hospitalization, 5(16.7%) were having 4-6 days of hospitalization 3 (10%) were having 7-9 days of hospitalization and 3 (10%) were having more than 10 days of hospitalization where as in group II majority 12 (40%) were from 1-3 days of hospitalization, 8 (26.7%) were having history of 4-6 days of hospitalization 6 (20%) were having 7-9 days of hospitalization ,and 4 (13.3%) were having more than 10 days of hospitalization.

Regarding Diagnosis, in group 1 majority 29 (96.7.0%), had medical problems and 1(3.3%) had surgical problems where as in group II all 30 (100%), had medical problems.

With regard to**,** duration of intubation in group I majority 27 (90%) were from 1-3 days and 3 (10%) were from 4-6 days where as in group 11 all 30 (100%) werefrom 1-3 days.

By seeing Size of the E,T tube in group 1 majority of intubated patients 29(9.7%) had 7-8.5 size E.T tube and 1 (3.3%) had 9-9.5 size E.T tube where as group 11 all 30(100%) had 7-8.5 size E.T tube.

According to the History of previous hospitalization in group 1 majority 13 (43.3%) had no history of previous hospitalization, 8(26.7%) had with in one year, 5(16.7 %) had within 2-3 years and 4(13.3 %) were with more than 3 years, where as in group 11 majority 21 (70%) had no history of previous hospitalization, 5(16.6%) had with in one year, 2(6.7 %) had within 2-3 years and 2(6.7% had more than 3 years

Pretest level of airway clearance score, in group –I patients, no one had well cleared airway clearance, 6(20%) of them had moderately cleared level, 21(70%) of them had minimally cleared level and 3(10%) of them had very minimally cleared level. Where as in group –II patients, no one had well cleared airway clearance, 4(13.3%) of them had moderately cleared level, 22(73.4%) of them had minimally cleared level and 4 (13.3%) of them had very minimally cleared level. Statistically there was no significant difference between group I and group-11 and was assessed using chi square test.

Percentage distribution of post test level of airway clearance score, in group –I patients, no one had well cleared airway clearance,12 (40%) of them had moderately cleared level, 18 (70%) of them had minimally cleared level and no one had very minimally cleared level.

In group –II patients, 4(13.3%) had well cleared airway clearance, 26(86.7%) of them had moderately cleared level and no one had minimally cleared level and very minimally cleared level. Statistically there was significant difference in the level of airway clearance between group 1 and group-11 and was assessed using chi square test.

Comparison of pre test and post test airway clearance mean score between group -1 and group -11 revealed that in pretest, group -1 the airway clearance mean score was 12.20 where as in post test it was 11.03 and the mean airway clearance score difference was 0.87 . It was small and was not statistically significant and was as analyzed using students paired t-test.

In pre test group II airway clearance mean score was 13.07 where as in post test it was 7.23 and the mean airway clearance difference was 3.80. It was large and statistically significant and it was analyzed using students paired t-test.

In pretest group I had 12.20 mean airway clearance score where as in posttest they had 11.03 mean airway clearance score so the difference was 1.17 score The difference between Group group -1 and Group group -11 score was large and statistically significant. Differences between pretest and posttest score was analyzed using students paired t-test.

. Considering group -II patients, in pretest they had 13.07 mean airway clearance score where as in posttest they had 7.23 mean airway clearance score, so the difference was 5.83 score The difference between group I and group II wass large and is statistically significant. Differences between pretest and posttest score was analyzed using students paired t-test.

On an average, Group group -I group patients had mean difference with 95%confidence interval was 1.17 and percentage of airway clearance reduction score with 95% Confidence interval was 5.9% (3.3%-8.4%) where as in group II patients had mean difference with 95%confidence interval was 5.83 and percentage of airway clearance reduction score with 95% Confidence interval was 29.2% (24.8%--33.4%) . There was significant association between post test level of airway clearance score and patients demographic and clinical variables in Experiment-II group. Younger,

females and less duration of admission in hospital patients are having more reduced air clearance score than others. Statistically significance was calculated using chi square test.

6.3 Conclusion:

The Statistical evidence proved that the endotracheal suctioning with normal saline was effective in improving the airway clearance by maintaining a patent airway and reducing the risk of hypoxia among the intubated patients admitted in Intensive Medical Care Unit. Hence the researcher concluded that the endotracheal suctioning with normal saline can be used among intubated patients admitted in other settings ..

6.4 Implications:

The investigator had drawn several implications from this study for various areas such as nursing practice, nursing education, nursing administration and nursing research.

6.4.1 Implications for nursing practice

- Bed side nurses should take responsible for the intubated patients airway clearance and enhancement of endotracheal suctioning with normal saline for the intubated patients in Intensive Medical care unit..
- Endotracheal suctioning with normal saline for the intubated patients can be followed as it is effective in removing thick tenacious secretion there by improve the airway clearance among intubated patients in Intensive Medical care unit.

- Intubated patients airway clearance assessment should be considered as a part of the routine nursing care among intubated patients in Intensive Medical care unit. Instillation of normal saline prior to endotracheal suctioning are effective in removing thick tenacious secretion and it can be recommended instead of plain endotracheal suctioning.

6.4.2 Implications for nursing education

- Educate that good endotracheal suctioning is essential to remove the bronchial secretion and to maintain patent airway in intubated patients.
- Effective endotracheal suctioning with normal saline is important for the intubated patients in Intensive Medical care unit.
- The frequency of endotracheal suctioning is an area of controversy and may depend more on the patient's condition.

6.4.3 Implications for nursing research

- This study can be a baseline for future studies to build upon and motivate.
- A study can be done with large samples and also for long duration.
- A study can be done with endotracheal suctioning with normal saline and its
- effectiveness can be analyzed in the maintenance of airway clearance
- Research is also needed to determine the impact of endotracheal suctioning on
- patient's airway clearance.

6.4.4 Implications for nursing administration

- Administrator should pay special attention to new as well as student nurse to educate and evaluate their airway clearance procedure in the intensive medical care units.

- Administrator can encourage the nurses to assess the level of airway clearance of all the intubated patients and make it as one of the assessment procedure.
- Articles and materials needed for providing endotracheal suctioning with normal saline must be made available by the Administrative department.
- Nursing Administrator can formulate protocols to incorporate the endotracheal suctioning with normal saline.
- In service education programme can be conducted to disseminate the research findings for better practice.

6.5 Recommendations:

- A similar study can be replicated with larger sample for better generalization
- A comparative study can be done between normal saline endotracheal suctioning and bicarbonate endotracheal to evaluate the best.
- A study can be conducted to assess the knowledge, attitude and practice of nursing staff regarding endotracheal suctioning with normal saline
- The effectiveness of endotracheal suctioning with normal saline in combination with sodium bicarbonate solution can also be done
- A similar study can be conducted in other settings like Intensive respiratory Care Unit, Pediatric intensive care Unit and at any place where individual are intubated and ventilated.

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Appendices

APPENDIX – I

From

S. Alphonse Mary,
M.Sc., (N) I Year Student (Br-Medical Surgical Nursing),
College of Nursing,
Madurai Medical College, Madurai – 20.

To

The Head of the Department,
Department of Anaesthesiology,
Madurai Medical College,
Madurai.

Through

The Proper Channel

Respected Sir,

Sub : College of Nursing, Madurai Medical College, Madurai – M.Sc., (N) I Year Medical Surgical Nursing Student – Permission for conducting dissertation study – Request – Regarding.

As per the Indian Nursing Council and The Tamil Nadu Dr.M.G.R. Medical University curriculum requirement all branches of M.Sc., Nursing candidates are required to conduct a dissertation study for the partial fulfillment of the P.G. Degree course in their respective departments.

I have selected a study topic Effectiveness of Endo tracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji Hospital, Madurai, for my dissertation study.

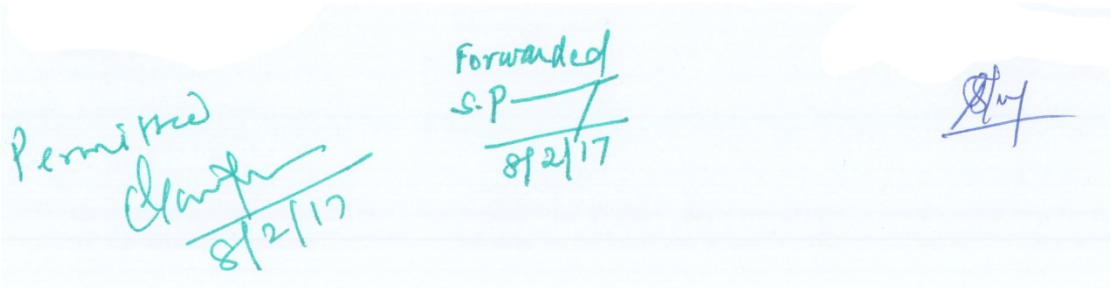
I assure that I will not interfere with the routine activities of the department.

Hence, I kindly request you to consider my requisition and permit me to conduct the study.

Thanking you

Date : 5.02.2017
Madurai

Yours obediently,
(S.ALPHONSE MARY)



From

S. Alphonse Mary,
M.Sc., (N) I Year Student (Br-Medical Surgical Nursing),
College of Nursing,
Madurai Medical College, Madurai – 20.

To

The Head of the Department,
Department of General Medicine,
Madurai Medical College,
Madurai.

Through

The Proper Channel

Respected Sir,

Sub : College of Nursing, Madurai Medical College, Madurai – M.Sc., (N) I Year Medical Surgical Nursing Student – Permission for conducting dissertation study – Request – Regarding.

As per the Indian Nursing Council and The Tamil Nadu Dr.M.G.R. Medical University curriculum requirement all branches of M.Sc., Nursing candidates are required to conduct a dissertation study for the partial fulfillment of the P.G. Degree course in their respective departments.

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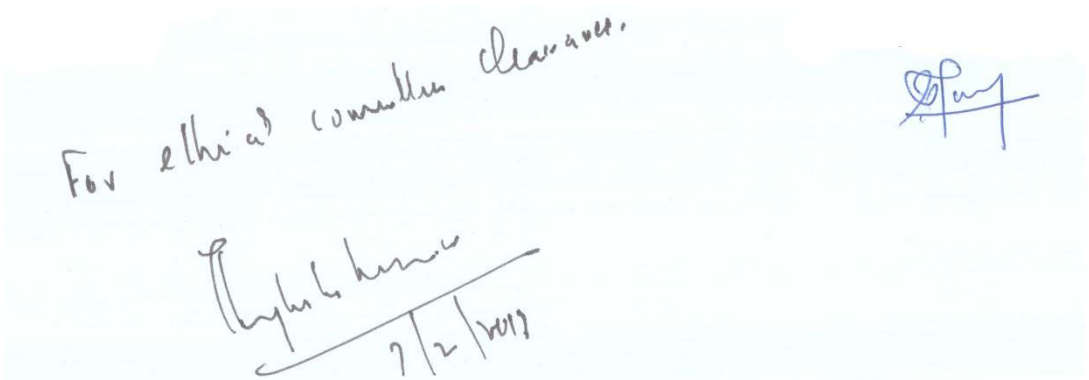

APPENDIX-II

MADURAI MEDICAL COLLEGE
MADURAI, TAMILNADU, INDIA -625 020
(Affiliated to The Tamilnadu Dr.MGR Medical University, Chennai, Tamil Nadu)

ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	S.Alphonse Mary
Course	:	M.Sc., Nursing (Medical and Surgical Nursing)
Period of Study	:	2015 - 2017
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Govt. Rajaji Hospital, Madurai.
Ethical Committee as on	:	08.02.2017

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary Chairman Dean / Convenor

Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc.(Hon)
CHAIRMAN
IEC - Madurai Medical College
Madurai

DEAN
Madurai Medical College
Madurai-20

APPENDIX-III

CONTENT VALIDITY CERTIFICATE

CERTIFICATE OF VALIDATION

This is to certify that the tool

SECTION A-Demographic data

SECTION B – Clinical variable

SECTION C—Check list for assessing airway clearance

Prepared for data collection by S.Alphonse Mary, II Year M.Sc(N) student, college of Nursing ,Madurai Medical college, Madurai, who has undertaken the study field on thesis entitled "**a study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji hospital , Madurai"** has been validated by me.

SIGNATURE OF THE EXPERT

PROFESSOR AND HEAD
DEPARTMENT OF MEDICINE
MADURAI MEDICAL COLLEGE
MADURAI-625 020.

Name:

Designation:

Institution:

CONTENT VALIDITY CERTIFICATE

CERTIFICATE OF VALIDATION

This is to certify that the tool

SECTION A-Demographic data

SECTION B – Clinical variable

SECTION C—Check list for assessing airway clearance

Prepared for data collection by S.AlphonseMary, II Year M.Sc(N) student, college of Nursing ,Madurai Medical college, Madurai, who has undertaken the study field on thesis entitled **"a study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji hospital , Madurai"** has been validated by me.

SIGNATURE OF THE EXPERT

Name: SAKTHI BHARATHI.N

Designation: ASSOC. PROFESSOR

Institution: SACRED HEART NURSING COLLEGE

MADURAI

CONTENT VALIDITY CERTIFICATE

CERTIFICATE OF VALIDATION

This is to certify that the tool

SECTION A-Demographic data

SECTION B – Clinical variable

SECTION C—Check list for assessing airway clearance

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SIGNATURE OF THE EXPERT

Name:

Designation: Principal.

Institution: Principal
Velammal College of Nursing
Madurai-625 009

CONTENT VALIDITY CERTIFICATE

CERTIFICATE OF VALIDATION

This is to certify that the tool

SECTION A-Demographic data

SECTION B – Clinical variable

SECTION C—Check list for assessing airway clearance

Prepared for data collection by S.AlphonseMary, II Year M.Sc(N) student, college of Nursing ,Madurai Medical college, Madurai, who has undertaken the study field on thesis entitled **"a study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearance among intubated patients at Government Rajaji hospital , Madurai"** has been validated by me.

SIGNATURE OF THE EXPERT

Name: ANDAL. P

Designation: Professor med surg. Nursing

Institution: Sacred Heart nursing college madurai-20

SACRED HEART NURSING COLLEGE
THASILDAR NAGAR
MADURAI-20.
4/285, COLLEGE ROAD

APPENDIX –IV

INFORMED CONSENT FORM

ஒப்புதல் அறிக்கை

பெயர்: **தேதி:**

எனக்கு இந்த ஆய்வைப் பற்றிய முழு விவரமும் விளக்கமாக எடுத்துரைக்கப்பட்டது. இந்த ஆய்வில் பங்கு பெறுவதில் உள்ள நன்மைகள் மற்றும் தீமைகள் பற்றி நான் புரிந்துகொண்டேன். நான் இந்த ஆய்வில் தானாகவே முன் வந்து பங்குபெறுகிறேன். மேலும் எனக்கு இந்த ஆய்வில் இருந்து எந்த நேரமும் விலகிக் கொள்ள முழு அனுமதி வழங்கப்பட்டுள்ளது. என்னுடைய சிகிச்சை ஆவணங்களைப் பார்வையிட்டு அதில் உள்ள விவரங்களை ஆய்வில் பயன்படுத்திக் கொள்ள அனுமதி அளிக்கின்றேன். என்னுடைய பெயர் மற்றும் அடையாளங்கள் ரகசியமாக வைத்து கொள்ளப்படும் என்றும் எனக்கு உறுதியளிக்கப்பட்டுள்ளது.

கையொப்பம்

APPENDIX--V

SEMISTRUCTURED INTERVEIW SCHEDULE

SECTION-A

SOCIODEMOGRAPHIC VARIABLES

Sample No---

S.NO	Socio Demographic variables		
1.	Age	*a)* 15 - 30 yrs	☐
		b) 31-45 yrs	☐
		c) 46-60 yrs	☐
		d) 61 – 75 Yrs	☐
2	Sex	*a)* Male	☐
		b) Female	☐
3	Occupation	*a)* Unemployed	☐
		b) Farmer	☐
		c) Private	☐
		d) Government	☐
		e) Industrial	☐
4	Area of residence	*a)* Town	☐
		b) Village	☐
5	History of smoking	*a)* Non smoking	☐
		b) 1-5 years	☐
		c) 6-10 years	☐
		d) 11-15 years	☐
		e) Above 15 years	☐
6	Duration of admission in hospital	a) 1-3days	☐
		b) 4 -6 days	☐
		c) 7—9 days	☐
		d) Above 10 days	☐

SEMISTRUCTURED INTERVEIW SCHEDULE

SECTION-B

CLINICAL VARIABLE

Sample No---

1. Diagnosis
   - a) medical ☐
   - b) surgical ☐
   - c) others ☐

2. Duration of intubation
   - a) 1-3 days ☐
   - b) 4-6 days ☐
   - c) 7-9 days ☐
   - d) Above 10 days ☐

3. Size of the endotracheal tube
   - a) 6---7 size ☐
   - b) 8—8.5 size ☐
   - c) 9—9.5 size ☐

4. History of previous hospitalization
   - a) With in one year ☐
   - b) 2-3 years ☐
   - c) more than 3years ☐
   - d) Nil ☐

SECTION C

STRUCTURED OBSERVATIONAL CHECK LIST FOR AIRWAY CLEARANCE

S.No	Observational parameters	Score
1	Changes in the heart rate a) 70—85 b) 86—100 c) 101—115 d) Above115	 1 2 3 4
2.	Changes in the Oxygen saturaion a) 100—96% b) 95---91% c) 90—86% d) Below 86%	 1 2 3 4
3.	Changes in the respiratory rate a) 12—18 b) 19—25 c) 26—32 d) Above 32	 1 2 3 4
4.	Presence of discomfort. a) absent b) mild dyspnoea c) moderate dyspnoea d) severe dyspnoea	 1 2 3 4
5.	Auscultation of lung fields. a) Normal vesicular breath sounds b) wheezing c) fine crepts d) coarse crepts	 1 2 3 4

Scoring key

S.no	Score	Level of airway clearance
1	**1—5**	**Well cleared**
2	**6—10**	**Moderately cleared**
3	**11—15**	**Minimally cleared**
4	**16—20**	**Very Minimally cleared**

APPENDIX VI

ஆராய்ச்சியாளரின் வடிவமைக்கப்பட்ட நேர்காணல் படிவம்

பகுதி-அ

தன்னிலை விபரக்குறிப்பு

நேர்காணல் படிவம்

குறிப்பு: எதிரே உள்ள கட்டங்களில் (✓மார்க் செய்யவும்

1. வயது வருடங்களில்

அ. *15-30* ☐

ஆ. *31-45* ☐

இ. *46-60* ☐

ஈ. *61-75* ☐

2. பாலினம்

அ. ஆண் ☐

ஆ. பெண் ☐

3. தொழில்

அ. வேலை இல்லை ☐

ஆ. விவசாயி ☐

இ. தனியார் வேலை ☐

ஈ. அரசாங்க வேலை ☐

உ. தொழிற்சாலை சம்பந்தமான வேலை ☐

4. வாழும் இடம்

அ. நகரம் ☐

ஆ. கிராமம் ☐

5. புகைப்பிடித்தல் பற்றிய விபரம்

அ. புகை பிடிக்காதவர் ☐

ஆ. *1-5* வருடங்களாக புகைப்படித்தல் ☐

இ. *6-10* வருடங்களாக புகைப்பிடித்தல் ☐

ஈ. *11-15* வருடங்களாக புகைப்பிடித்தல் ☐

உ. *15* வருடங்களுக்கு மேலாக ☐

6. மருத்துவமனையில் அனுமதிக்கப்பட்டிருக்கும் நாட்களின் எண்ணிக்கை

அ. 1-3 தினங்கள் ☐

ஆ. 4-6 தினங்கள் ☐

இ. 7-9 தினங்கள் ☐

ஈ. 10 தினங்களுக்கு மேலாக ☐

மருத்துவமாறி விபரக்குறிப்பு

1. நோயின் தன்மை

அ. மருத்துவம் சம்பந்தப்பட்டது ☐

ஆ. அறுவை சிகிச்சை சம்பந்தப்பட்டது ☐

இ. மற்றவை ☐

2. பெருமூச்சுக் குழலில் செருகுக்குழல் போட்டு எத்தனை நாளாகிறது

அ. 1-3 நாட்கள் ☐

ஆ. 4-6 நாட்கள் ☐

இ. 7-9 நாட்கள் ☐

ஈ. 9 நாட்கள் மேலாக ☐

3. மூச்சு பெருங்குழலுள் குழாய் அளவு

அ. 6-7 அளவு ☐

ஆ. 7-8.5 அளவு ☐

இ. 9-9.5 அளவு ☐

4. மருத்துவமனையில் அனுமதிக்கப்பட்டு எத்தனை நாளாகிறது

அ. ஒரு வருடத்துக்குள் ☐

ஆ. 2-3 வருடங்களுக்குள் ☐

இ. 3 வருடங்களுக்கு மேலாக ☐

ஈ. அனுமதிக்கப்படவில்லை ☐

APPENDIX – VII

CONTENT VALIDITY CERTIFICATE

CERTIFICATE OF VALIDATION

This is to certify that the tool

SECTION A-Demographic data

SECTION B – Clinical variable

SECTION C—Check list for assessing airway clearance

Prepared for data collection by S.AlphonseMary, II Year M.Sc(N) student, college of Nursing ,Madurai Medical college, Madurai, who has undertaken the study field on thesis entitled "**a study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline among intubated patients at Government Rajaji hospital , madurai"** has been validated by me.

SIGNATURE OF THE EXPERT

Name: S. BAGRUDEEN,

Designation: S. BAGRUDEEN, MA.,BSc.,M.Ed.,
P/T. Professor of English
(I-Year BSc Nursing)

Institution: Madurai Medical College
Madurai - 625020.

APPENDIX – VIII

TAMIL EDITING CERTIFICATE

TO WHOM SO EVER IT MAY CONCERN

This is to certify that the dissertation "**a study to evaluate the effectiveness of endotracheal suctioning with normal saline versus without normal saline on airway clearence among intubated patients at Government Rajaji hospital, Madurai"** done by Mrs.S. AlphonseMary, II year M.Sc,Nursing student, college of Nursing, Madurai Medical college, Madurai-20 has been edited for Tamil Language appropriateness.

Name: M.GNANA HEPSI BAH

Designation: B.A, M.A, M.Ed, M.Phil, Ph.D

Institution: St. Hindu colledge, Nagercoil

M.G. Hepsi Bah
Signature

APPENDIX – IX

PROCEDURE FOR ENDOTRACHEAL SUCTIONING

10 considerations that may provide some assistance in determining what the best practice methods are for performing ETS.

1. Frequency of Suctioning

Although there has been a very limited number of studies regarding a scheduled frequency of performing ETS every 1, 3, 4, 6, 8, or even 12 hours, the overall recommendation is to suction only as indicated (as needed).The reason for this is because there is considerable risk with using “routine” suctioning. It has been suggested by Pedersen et al that ETS should be performed at least every 8 hours to slow the formation of the secretion biofilm within the lumen of the endotracheal tube (ETT). Clifton-Koeppel1 made a good general recommendation that ETS should be performed as infrequently as possible—yet as much as needed.

2. Preoxygenation

In general, studies have not yet shown the optimal level or duration for the use of preoxygenation for ETS. In adults, the common practice is to preoxygenate with 100% oxygen before, during, and for some period after performing ETS. Prolonged hyperoxia may lead to free-radical tissue damage, absorption atelectasis (nitrogen washout), and loss of lung volume. In preterm infants, the practice of using 100% oxygen is avoided because of the possible deleterious effects of hyperoxia that can cause retinopathy of prematurity. Also in preterm infants, the level of brain oxygenation decreases in parallel with the drop in oxygen saturation, but is also ameliorated with a sustained increase of 10% in the oxygen setting.Also in infants there is a possibility of bradycardia and apnea when preoxygenation is not provided.[2]Therefore, many neonatal intensive care units (NICUs) have a protocol

whereby the oxygen is increased by 10% to 20% before ETS. Another concern is providing hyperoxia to patients in cardiac units who have cyanotic heart disease, since the hyperoxia may cause pulmonary vascular dilation and decreased preload to the left heart resulting in systemic hypotension.

3. Vacuum Pressure Level

Although studies of vacuum pressure of up to 360 mm Hg have shown positive results, the general recommendation is to use between 70 and 150 mm Hg—except when there are thick secretions, where up to 200 mm Hg is used with the appropriate suction catheter size. The actual negative pressure delivered at the tip of the ETT is not the same as the manometer setting since it depends on the size of the catheter and ETT, the duration of suction, and the volume and viscosity of the secretions. One interesting thing to note about ETS is that negative pressure is created inside of the lungs only while air flows out of the suction catheter. As soon as secretions are aspirated into the catheter, the intrapulmonary pressure returns to that of the atmospheric level, and lung volume loss stops. However, if ETS is performed when there are no secretions, it may cause significant atelectasis. Clinicians must weigh the impact of potential mucosal injury or other problems at a high vacuum level, or using repeated suction passes when a lower vacuum pressure is utilized. It is now generally recommended to use the lowest vacuum pressure to avoid the incidence or degree of hypoxia, atelectasis, and tracheal mucosa injury.

4. Suction Catheter Size

If a suction catheter is too large for the ETT, and/or there is too much vacuum pressure, massive atelectasis may occur. Therefore, the general recommendation is to use a suction catheter that has an external diameter less than 50% of the size of the

ETT inner diameter. In some cases, however, this recommendation is not possible—for example, with a size 2.5 or 3.0 ETT, since the smallest size suction catheter will occlude 75% of the ETT lumen. One method to calculate the French (Fr) suction catheter size is: Fr = (ETT size [mm] – 1) x 2, which is relatively accurate. A suction catheter with an outer diameter that occludes less than 40% of the ETT internal diameter may be insufficient to clear secretions, necessitating the use of multiple passes. Also, when there is a leak around the ETT, it is more difficult to cause a loss of lung volume during ETS because air can still be inspired from around the outside of the ETT. The general recommendation is to use a suction catheter that occludes less than one-half the internal diameter of the ETT lumen and to use the smallest suction catheter that will effectively and safely aspirate the secretions.

5. Open or Closed System Suctioning

During open endotracheal suctioning (OES), the patient is temporarily removed from the ventilator to breathe freely, or manually ventilated, while ETS is performed. Some studies have shown that there is more secretion removal with OES.Conversely, with closed system suctioning (CSS), the patient remains attached to the ventilator, or their supplemental breathing device, and a reusable inline (enclosed) catheter is used for ETS. Remaining connected to the ventilator helps prevent both the loss of positive end expiratory pressure (PEEP) and the loss of lung volume. One bench test study of CSS showed that the high inspiratory flow from the mechanical ventilator pushes the secretions away from the suction catheter and further into the lungs. In infants, CSS has been shown to be physiologically better tolerated by the patient because of much less desaturation and less incidence and length of bradycardia. The use of CSS may prevent hypoxia and decreases in lung volume for both pediatric and adult patients. Using CSS also has the potential for lessening the

spread of infection to patients and staff. Most clinical staff prefer CSS for the ease of use, less time involved, and better patient toleration. Some studies have shown no significant difference in ventilator-associated pneumonia (VAP) occurrence between open or closed ETS. Patients with high positive end expiratory pressure will usually tolerate CSS better than OES. According to Morrow and Argent, and Pedersen et al, no studies have shown generally an overall superiority between open and closed ETS, and it is up to the clinician to decide which method of ETS is better for the patient.

6. Depth of Catheter Insertion

There are two schools of thought regarding the depth of catheter insertion for ETS. These are to use either deep or shallow suctioning. In two randomized crossover studies of high-risk neonates, there were no significant differences in heart rate responses and oxygen saturation between deep and shallow suctioning. For deep ETS, the catheter is inserted until it is beyond the tip of the ETT, or until it touches the carina. Deep suctioning is usually needed when there are large amounts of secretions in the lower airways.The drawback with deep ETS is that there is some degree of mucosal injury and the potential for bleeding, as well as the possibility of vagal stimulation and bradycardia. Also, there is the possibility of mucosal ulceration and necrosis, or inflammation, with repeated deep ETS.

The second method of suctioning is the shallow (premeasured) technique, which is also considered minimally invasive. With shallow ETS, the catheter is inserted only to the tip of the ETT, thereby avoiding injury to the airway. Premeasured suctioning requires that the approximate depth to the tip of the ETT be estimated by using a suction catheter that has graduated centimeter markings. The centimeter marking of the ETT at the lip is then noted before the

suction catheter is inserted to the same distance that exists from the lip to the tip of the ETT. There is also no cough stimulated with shallow ETS, which means that the maneuver will only clear secretions from within the lumen of the ETT.Until some more conclusive randomized studies are done to compare deep and shallow suctioning, the general recommendation is to minimize the use of deep suctioning.

7. Continuous or Intermittent Suction

In Pedersen et al's systematic review of ETS, it was determined that continuous suctioning rather than intermittent suctioning should be used because there was a study that showed that intermittent suctioning in dogs caused significant damage to tracheal tissue. Another study showed that there is a risk of alveolar collapse when intermittent suction is used with a closed suction catheter.

8. Duration of Suctioning

Considering what was previously presented about vacuum pressure, it should be clear that a longer duration of suction can increase the negative pressure within the lungs and reduce lung volumes. A longer duration of suction also increases the risk of hypoxia and its associated complications. In Pedersen et al's review of ETS, it was stated that the maximum duration of suctioning is inadequately documented. Morrow and Argent recommend a suction duration of 10 to 15 seconds for adults and 5 seconds or less for pediatric patients and neonates, which is a good general recommendation for suction duration.

9. Normal Saline Instillation

There is a general belief that normal saline instillation (NSI) lubricates the ETT so that the suction catheter will pass more easily and dilutes secretions and helps to stimulate a cough. A recent study by Caruso et al in which 8 ml of normal saline

was instilled before ETS demonstrated that saline can effectively decrease the microbiologically proven incidence of VAP more so than ETS without NSI. In infants with a size 2.5 mm ETT, the use of NSI helps keep the lumen of the tube open. Morrow and Argent stated that NSI should not be routinely used with ETS, but adequate airway humidification is essential, which is a good general recommendation.

10. Lung Volume Recruitment Maneuvers

Recruitment maneuvers (RM) are performed after ETS to help recover any loss of lung volumes that occur during suctioning. An RM is performed by applying a sustained inflation pressure, for instance, 30 cm H_2O x 30 seconds, within the lungs for a short time. According to Laplace's Law, a high inspiratory pressure is required to reinflate collapsed alveoli. The concern is that the aerated alveoli can become overdistended when an RM is applied. In one canine study, investigators used different models of acute lung injury (ALI) with an RM and showed varied results. In studies with anesthetized lambs and sheep without ALI, the RM was beneficial, however. In another study involving infants and children receiving an RM following ETS, there was transient improvement in oxygenation and airway resistance, but no effect upon dynamic compliance compared to the control group. In many cases, pulmonary compliance returns to baseline within 10 minutes, regardless of whether an RM is applied or not. The RM is sometimes terminated early due to hypotension or desaturation. Morrow and Argent concluded in an extensive evidence-based review of ETS that further research is needed for RM and that in children it does not seem to be beneficial.

APPENDIX – X


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